EXHIBIT 16

Google's Pixel phones might have a serious audio problem

Raymond Wong

The Google Pixel and Pixel XL.

Image: Dustin drankoski/mashable

Dull design aside, the Google Pixel and Pixel XL are two of the best premium Android phones (if not the best) you can buy right now. But there might be an issue with their speakers, especially at high volumes.

Reddit user Mark "badmark" Buckman brought to attention the problem after posting a video of his Pixel and Pixel XL exhibiting audio distortion when the volume is turned to their highest levels.

With the volumed cranked all the way up, the Perfect Piano app is virtually unusable. As you drag your fingers along the keys, the keys sound more like static with lots of audio popping.

The issue also only rears itself when the volume set to its loudest with the Perfect Piano app and the audio is played through the speaker; headphones seem to work fine.

Mashable was able to replicate the same audio problem on a Pixel and two separate Pixel XLs. The issue remained even when we updated the phones from Android 7.1 to 7.1.1. The same tests on a OnePlus 3T running Android 6.1 Marshmallow, and an iPhone 7 running iOS 10.2, however, had no such audio distortions.

Pixel owners have been reporting on audio popping and clicking issues since late October.

A post from a Pixel XL owner, Ryan Lestage, on Google's official Pixel user community forum, from back on Oct. 24, suggests the audio issues extend to all audio including "talk radio or music played in Chrome, Facebook, TuneIn Radio, YouTube, etc."

Mashable wasn't able to reproduce the issues in other commonly used music apps such as YouTube, Chrome, Spotify or Pandora.

Given the different user reports, it's unclear exactly what's causing the speaker problems.

Mashable reached out to Google and received this statement from a company spokesperson: "We're aware of an issue affecting audio quality for some apps on Pixel and we're actively working on a fix."

Does your Pixel or Pixel XL have audio issues? Let us know on Twitter at @MashableTech.

UPDATE: Dec. 20, 2016, 12:28 p.m. EST *with the above statement from Google.*

EXHIBIT 17

Google responds to Pixel microphone issues with official replacement program

Michael Simon

In a post on the Pixel Phone Help board, a Google employee explains how users can go about exchanging their phones.

By

Staff Writer, Greenbot | Mar 9, 2017 9:41 AM PT

Jason Cross

The Pixel has mostly enjoyed a smooth, successful launch, but it hasn't been without its problems. First there was an [audio issue](#) that affected playback at high volumes. Then a [Bluetooth problem](#) caused random disabling of connected devices. However, while both of those issues were patched via a software update, it looks like a new problem might not have such an easy fix.

First uncovered by [Android Police](#), Google has taken to the [Pixel Phone Help board](#) to address issues regarding malfunctioning microphones. In the original Oct. 20 post, a user says that he "received my Pixel today and after a few hours of use and set up, the microphone stopped working entirely, except when recording video, upon which it'll record audio fine as if nothing were wrong. I factory reset the phone and the issue still persists everywhere but the camera app." This was followed by hundreds of comments from users experiencing similar problems.

Google employee Brian Rakowski responded to the post by saying the company is aware of the issue and that a software update will not be able to fix it, as it pertains to a flaw in the manufacturing. As he explains: "The most common problem is a hairline crack in the solder connection on the audio codec. This will affect all three mics and may result in other issues with audio processing. This problem tends to be transient because of the nature of the crack. Based on temperature changes or the way you hold the phone, the connection may be temporarily restored and the problems may go away. This is especially frustrating as a user because, just when you think you've got it fixed, the problem randomly comes back. We believe this problem is occurring in less than 1% of phones and often happens after a few months of use (it could be triggered by dropping the phone that may not cause any visible external damage)."

However, help is on the way. Rakowski says that Google will replace any Pixels exhibiting this problem and "are taking additional steps to qualify refurbished phones to make sure they don't have this mic problem." He says that Pixel phones manufactured within the past month shouldn't exhibit the microphone flaw and recommends going back to the place where you purchased the phone to request a warranty replacement.

Now hear this: The Pixel is a new project for Google, and with all new ventures, problems will rise. However, Google is handling them right. With previous issues, employees clearly detailed what was happening and how it would be fixed via a software update. With this one, Google is doing the right thing by exchanging the defective units for new ones, regardless of whether the problem was exasperated by a fall. This will only strengthen the Pixel brand.

Michael Simon covers all things mobile for PCWorld and Macworld. You can usually find him with his nose buried in a screen. The best way to yell at him is on Twitter.

DECLARATION OF BOBBIE J. WILSON

EXHIBIT 18

(Redacted Version - Sought to be Sealed)

DECLARATION OF BOBBIE J. WILSON

EXHIBIT 19

(Redacted Version - Sought to be Sealed)

DECLARATION OF BOBBIE J. WILSON

EXHIBIT 20

(Redacted Version - Sought to be Sealed)

EXHIBIT 21

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Verizon Wireless Customer Agreement

My Verizon Wireless Customer Agreement

(Para una copia de este documento en Español, visite nuestro website: vzw.com/espanol.)

Thanks for choosing Verizon Wireless. In this Customer Agreement, you'll find important information about your Service, including our ability to make changes to your Service or this agreement's terms, our liability if things don't work as planned and how any disputes between us must be resolved in arbitration or small claims court . If you're signing up for Service for a minimum contract term, you'll also find information about that contract term and what happens if you cancel a line of Service early or don't pay on time, including the possibility of an early termination fee you may owe Verizon Wireless.

My Service

Your Service terms and conditions are part of this agreement. Your Plan includes your monthly allowances and features, where you can use them (your "Coverage Area"), and their monthly and pay–per–use charges. You can also subscribe to several Optional Services, like data add–on packages. Together, your Plan and any Optional Services you select are your Service. The terms and conditions for your Service can be found in the brochures that are available when you activate, or online at **verizonwireless.com**

How do I accept this Agreement?

You accept this Agreement by:

- Agreeing in writing, by email, over the phone, or in person;
- Opening a package that says you are accepting by opening it; or
- Activating your Service.

When you accept, you're representing that you are at least 18 years old and are legally able to accept an agreement. If you're accepting for an organization, you're representing that you are authorized to bind that organization, and where the context requires, "you" means the organization. By accepting you are agreeing to every provision of this Agreement whether or not you have to read it.

If you do accept, you can cancel a line of Service within 14 days of accepting this Agreement without having to pay an early termination fee as long as you return, within the applicable return period, any equipment you purchased from us or one of our authorized agents at a discount in connection with your acceptance of this Agreement, but you'll still have to pay for your Service through that date. If you signed up for Prepaid Service, no refunds will be granted after 14 days or if your account has been activated.

If you change your device or receive a Service promotion, you may be required to change your Plan to one that we are currently offering at that time.

If you do accept, you can cancel a line of Service within 14 days of accepting this Agreement without having to pay an early termination fee as long as you return, within the applicable return period, any equipment you purchased from us or one of our authorized agents at a discount in connection with your acceptance of this Agreement, but you'll still have to pay for your Service through that date. If you signed up for Prepaid Service, no refunds will be granted after 14 days or if your account has been activated.

If you change your device or receive a Service promotion, you may be required to change your Plan to one that we are currently offering at that time.

My privacy

We collect personal information about you. We gather some information through our relationship with you, such as information about the quantity, technical configuration, type, destination and amount of your use of our telecommunications services. You can find out how we use, share and protect the information we collect about you in the Verizon Privacy Policy, available at **verizon.com/privacy.** By entering this

Agreement, you consent to our data collection, use and sharing practices described in our Privacy Policy. We provide you with choices to limit, in certain circumstances, our use of the data we have about you. You can review these choices at **verizon.com/privacy#limits**. If there are additional specific advertising and marketing practices for which your consent is necessary, we will seek your consent (such as through the privacy–related notices you receive when you purchase or use our products and services) before engaging in those practices. If you subscribe to Service for which usage charges are billed at the end of the billing period ("Postpay Service"), we may investigate your credit history at any time and share credit information about you with credit reporting agencies and other Verizon companies. If you'd like the name and address of any credit agency that gives us a credit report about you, just ask.

Many services and applications offered through your device may be provided by third parties. Before you use, link to or download a service or application provided by a third party, you should review the terms of such service or application and applicable privacy policy. Personal information you submit may be read, collected or used by the service or application provider and/or other users of those forums.

You consent to allow Verizon Wireless and anyone who collects on our behalf to contact you about your account status, including past due or current charges, using prerecorded calls, email and calls or messages delivered by an automatic telephone dialing system to any wireless phone number or email address you provide. Verizon Wireless will treat any email address you provide as your private email that is not accessible by unauthorized third parties. Unless you notify us that your wireless service is based in a different time zone, calls will be made to your cellular device during permitted calling hours based upon the time zone affiliated with the mobile telephone number you provide.

What happens if my Postpay Service is canceled before the end of my contract term?

If you're signing up for Postpay Service, you're agreeing to subscribe to a line of Service either on a month–to–month basis or for a minimum contract term, as shown on your receipt or order confirmation. (If your Service is suspended without billing, or at a reduced billing rate, that time doesn't count toward completing your contract term.) Once you've completed your contract term, you'll automatically become a customer on a month–to–month basis for that line of Service. **If you cancel a line of Service, or if we cancel it for good cause, during its contract term, you'll have to pay an early termination fee. If your contract term results from your purchase of an advanced device on or after November 14, 2014, your early termination fee will be $350, which will decline by $10 per month upon completion of months 7–17, by $20 per month upon completion of months 18–22, and by $60 upon completion of month 23 and will be $0 upon completion of your contract term. For other contract terms entered into on or after November 14, 2014, your early termination fee will be $175, which will decline by $5 per month upon completion of months 7–17, $10 per month upon completion of months 18–22, $30 upon completion of month 23 and will be $0 upon completion of your contract term. If your contract results from your purchase of an advanced device prior to November 14, 2014, your early termination fee will be $350 minus $10 for each full month of your contract term that you complete. For other contract terms entered into prior to November 14, 2014, your early termination fee will be $175 minus $5 for each full month of your contract term that you complete. Cancellations will become effective on the last day of that month's billing cycle,** and you are responsible for all charges incurred until then. Also, if you bought your wireless device from an authorized agent or third–party vendor, you should check whether they charge a separate termination fee.

Can I take my wireless phone number to another carrier?

You may be able to take, or "port", your wireless phone number to another carrier. If you port a number from us, we'll treat it as though you asked us to cancel your Service for that number. After the porting is completed, you won't be able to use our service for that number, but you'll remain responsible for all fees and charges through the end of that billing cycle, just like any other cancellation. If you're a Prepaid customer, you won't be entitled to a refund of any balance on your account. If you port a number to us, please be aware that we may not be able to provide some services right away, such as 911 location services. You don't have any rights to your wireless phone number, except for any right you may have to port it.

Directory information

We will not publish your wireless phone number in any available directory or give it to anyone for that purpose, unless you ask us to.

Can I have someone else manage my Postpay account?

No problem – just tell us by phone, in person, or in writing. You can appoint someone to manage your Postpay account for a single transaction, or until you tell us otherwise. The person you appoint will be able to make changes to your account, including adding new lines of Service, buying new wireless devices, and extending your contract term. Any changes that person makes will be treated as modifications to this agreement.

Can Verizon Wireless change this Agreement or my Service?

We may change prices or any other term of your Service or this agreement at any time, but we'll provide notice first, including written notice if you have Postpay Service. If you use your Service after the change takes effect, that means you're accepting the change. If you're a Postpay customer and a change to your Plan or this agreement has a material adverse effect on you, you can cancel the line of Service that has been affected within 60 days of receiving the notice with no early termination fee if we fail to negate the change after you notify us of your objection to it. Notwithstanding this provision, if we make any changes to the dispute resolution provision of this Agreement, such changes will not affect the resolution of any disputes that arose before such change.

My wireless device

Your wireless device must comply with Federal Communications Commission regulations, be certified for use on our network, and be compatible with your Service. Please be aware that we may change your wireless device's software, applications or programming remotely, without notice. This could affect your stored data, or how you've programmed or use your wireless device. By activating Service that uses a SIM (Subscriber Identity Module) card, you agree we own the intellectual property and software in the SIM card, that we may change the software or other data in the SIM card remotely and without notice, and we may utilize any capacity in the SIM card for administrative, network, business and/or commercial purposes. If you bought a wireless device for Postpay Service from Verizon Wireless that doesn't use a SIM card, and you want to reprogram it for use with another wireless network, the default programming code is set to "000000" or "123456." But please note that your wireless device may not work with another wireless network, or the other wireless carrier may not accept your wireless device on its network. If you activate a 3G phone–in–the–box wireless device for Prepaid Service, it can only be used for Prepaid Service during the first six (6) months after activation. If you activate a 4G LTE phone–in–the–box wireless device for Prepaid Service, it cannot be used with any other service until it is first activated on Prepaid Service and the first monthly payment is made.

Where and how does Verizon Wireless Service work?

Wireless devices use radio transmissions, so unfortunately you can't get Service if your device isn't in range of a transmission signal. And please be aware that even within your Coverage Area, many things can affect the availability and quality of your Service, including network capacity, your device, terrain, buildings, foliage and weather.

How can I prevent unintended charges on my bill?

You agree to pay all access, usage and other charges that you or any other user of your wireless device incurred. If multiple wireless devices are associated with your account, you agree to pay all charges incurred by users of those wireless devices. Many services and applications are accessible on or through wireless devices, including purchases of games, movies, music and other content. Some of these services are provided by Verizon Wireless. Others are provided by third parties that may offer the option to bill the charges to your Verizon Wireless bill or other methods of payment. Charges may be one–time or recurring. The amount and frequency of the charges will be disclosed to you or the person using your device or a device associated with your account at the time a purchase is made. If the purchaser chooses to have the charges billed to your account, such charges will become part of the amount due for that billing cycle. **Verizon Wireless offers tools to block or restrict these services, and to block all billing for third–party services on your Verizon Wireless bill, at verizonwireless.com/myverizon**

What charges are set by Verizon Wireless?

For Postpay Service, our charges include Federal Universal Service, Regulatory and Administrative charges, and we may also include other charges related to our governmental costs. We set these charges; they aren't taxes, they aren't required by law, they are not necessarily related to anything the government does, they are kept by us in whole or in part, and the amounts and what they pay for may change.

Government taxes, fees and surcharges

You must pay all taxes, fees and surcharges set by federal, state and local governments. Please note that we may not always be able to notify you in advance of changes to these charges.

What are roaming charges?

You're "roaming" whenever your wireless device uses a transmission site outside your Coverage Area or uses another company's transmission site. Sometimes roaming happens even when you're within your Coverage Area. There may be higher rates and extra charges (including charges for long distance, tolls or calls that don't connect) for roaming calls, depending on your Plan.

How does Verizon Wireless calculate my charges?

For charges based on the amount of time used or data sent or received, we'll round up any fraction to the next full minute or, depending on how you're billed for data usage, the next full megabyte or gigabyte. For outgoing calls, usage time starts when you first press **Send** or the call connects to a network, and for incoming calls, it starts when the call connects to a network (which may be before it rings). Usage time may end several seconds after you press **End** or after the call disconnects. For calls made on our network, we charge only for calls that are answered, including by machines. For Postpay Service, usage cannot always be processed right away and may be included in a later bill, but the usage will still count towards your allowance for the month when the Service was used.

How and when can I dispute charges?

If you're a Postpay customer, you can dispute your bill within 180 days of receiving it, but unless otherwise provided by law or unless you're disputing charges because your wireless device was lost or stolen, you still have to pay all charges until the dispute is resolved. If you're a Prepaid customer, you can dispute a charge within 180 days of the date the disputed charge was incurred. **YOU MAY CALL US TO DISPUTE CHARGES ON YOUR BILL OR ANY SERVICE(S) FOR WHICH YOU WERE BILLED, BUT IF YOU WISH TO PRESERVE YOUR RIGHT TO BRING AN ARBITRATION OR SMALL CLAIMS CASE REGARDING SUCH DISPUTE, YOU MUST WRITE TO US AT THE CUSTOMER**

SERVICE ADDRESS ON YOUR BILL, OR SEND US A COMPLETED NOTICE OF DISPUTE FORM (AVAILABLE AT VERIZONWIRELESS.COM), WITHIN THE 180–DAY PERIOD MENTIONED ABOVE. IF YOU DO NOT NOTIFY US IN WRITING OF SUCH DISPUTE WITHIN THE 180–DAY PERIOD, YOU WILL HAVE WAIVED YOUR RIGHT TO DISPUTE THE BILL OR SUCH SERVICE(S) AND TO BRING AN ARBITRATION OR SMALL CLAIMS CASE REGARDING ANY SUCH DISPUTE.

What are my rights for dropped calls or interrupted service?

If you drop a call in your Coverage Area, redial. If it's answered within 5 minutes, call us within 90 days if you're a Postpay customer, or within 45 days if you're a Prepaid customer, and we'll give you a 1–minute airtime credit. If you're a Postpay customer and you lose Service in your Coverage Area for more than 24 hours in a row and we're at fault, call us within 180 days and we'll give you a credit for the time lost. Please be aware that these are your only rights for dropped calls or interrupted Service.

About my payments

If you're a Postpay customer and we don't get your payment on time, we will charge you a late fee of up to 1.5 percent per month (18 percent per year) on the unpaid balance, or a flat $5 per month, whichever is greater, if allowed by law in the state of your billing address. (If you choose another company to bill you for our Service [such as another Verizon company], late fees are set by that company or by its tariffs and may be higher than our late fees.) Late fees are part of the rates and charges you agree to pay us. If you fail to pay on time and Verizon Wireless refers your account(s) to a third party for collection, a collection fee will be assessed and will be due at the time of the referral to the third party. The fee will be calculated at the maximum percentage permitted by applicable law, not to exceed 18 percent. We may require a deposit at the time of activation or afterward, or an increased deposit. We'll pay simple interest on any deposit at the rate the law requires. We may apply deposits or payments in any order to any amounts you owe us on any account. If your final credit balance is less than $1, we will refund it only if you ask. If your service is suspended or terminated, you may have to pay a fee to have service reactivated.

If you're a Prepaid customer, you may replenish your balance at any time before the expiration date by providing us with another payment. Your balance may not exceed $1,000 and you may be prevented from replenishing if your balance reaches $1,000. We will suspend service when your account reaches the expiration date and any unused balance will be forfeited.

We may charge you up to $25 for any returned check.

What if my wireless device gets lost or stolen?

We're here to help. It's important that you notify us right away, so we can suspend your Service to keep someone else from using it. If you're a Postpay customer and your wireless device is used after the loss or theft but before you report it, and you want a credit for any charges for that usage, we're happy to review your account activity and any other information you'd like us to consider. Keep in mind that you may be held responsible for the charges if you delayed reporting the loss or theft without good reason, but you don't have to pay any charges you dispute while they are being investigated. If you're a California customer and we haven't given you a courtesy suspension of recurring monthly charges during the past year, we'll give you one for 30 days or until you replace or recover your wireless device, whichever comes first.

What are Verizon Wireless rights to limit or end service or end this Agreement?

We're here to help. It's important that you notify us right away, so we can suspend your Service to keep someone else from using it. If you're a Postpay customer and your wireless device is used after the loss or theft but before you report it, and you want a credit for any charges for that usage, we're happy to review your account activity and any other information you'd like us to consider. Keep in mind that you may be held responsible for the charges if you delayed reporting the loss or theft without good reason, but you don't have to pay any charges you dispute while they are being investigated. If you're a California customer and we haven't given you a courtesy suspension of recurring monthly charges during the past year, we'll give you one for 30 days or until you replace or recover your wireless device, whichever comes first.

Am I eligible for special discounts?

If you're a Postpay customer, you may be eligible for a discount if you are and remain affiliated with an organization that has an agreement with us. Unless your discount is through a government employee discount program, we may share certain information about your Service (including your name, your wireless telephone number and your total monthly charges) with your organization from time to time to make sure you're still eligible. We may adjust or remove your discount according to your organization's agreement with us, and remove your discount if your eligibility ends or your contract term expires. In any case, this won't be considered to have a material adverse effect on you.

Disclaimer of warranties

We make no representations or warranties, express or implied, including, to the extent permitted by applicable law, any implied warranty of merchantability or fitness for a particular purpose, about your Service, your wireless device, or any applications you access through your wireless device. We do not warrant that your wireless device will work perfectly or will not need occasional upgrades or modifications, or that it will not be negatively affected by network–related modifications, upgrades or similar activity. If you download or use applications, services or software provided by third parties (including voice applications), 911 or E911, or other calling functionality, may work differently than services offered by us, or may not work at all. Please review all terms and conditions of such third–party

products. Verizon Wireless is not responsible for any third–party information, content, applications or services you access, download or use on your device. You are responsible for maintaining virus and other Internet security protections when accessing these third–party products or services. For additional information, visit the Verizon Content Policy at responsibility.verizon.com/contentpolicy

Please be aware that if you activated your wireless device through our Open Development program, we can't vouch for the device's call quality or overall functionality.

Waivers and limitations of liability

You and Verizon Wireless both agree to limit claims against each other for damages or other monetary relief to direct damages. This limitation and waiver will apply regardless of the theory of liability. That means neither of us will try to get any indirect, special, consequential, treble or punitive damages from the other. This limitation and waiver also applies if you bring a claim against one of our suppliers, to the extent we would be required to indemnify the supplier for the claim. You agree we aren't responsible for problems caused by you or others, or by any act of God. You also agree we aren't liable for missed or deleted voice mails or other messages, or for any information (like pictures) that gets lost or deleted if we work on your device. If another wireless carrier is involved in any problem (for example, while you're roaming), you also agree to any limitations of liability that it imposes.

How do I resolve disputes with Verizon Wireless?

WE HOPE TO MAKE YOU A HAPPY CUSTOMER, BUT IF THERE'S AN ISSUE THAT NEEDS TO BE RESOLVED, THIS SECTION OUTLINES WHAT'S EXPECTED OF BOTH OF US.

YOU AND VERIZON WIRELESS BOTH AGREE TO RESOLVE DISPUTES ONLY BY ARBITRATION OR IN SMALL CLAIMS COURT. YOU UNDERSTAND THAT BY THIS AGREEMENT YOU ARE GIVING UP THE RIGHT TO BRING A CLAIM IN COURT OR IN FRONT OF A JURY. WHILE THE PROCEDURES MAY BE DIFFERENT, AN ARBITRATOR CAN AWARD YOU THE SAME DAMAGES AND RELIEF, AND MUST HONOR THE SAME TERMS IN THIS AGREEMENT, AS A COURT WOULD. IF THE LAW ALLOWS FOR AN AWARD OF ATTORNEYS' FEES, AN ARBITRATOR CAN AWARD THEM TOO. WE ALSO BOTH AGREE THAT:

(1) THE FEDERAL ARBITRATION ACT APPLIES TO THIS AGREEMENT. EXCEPT FOR SMALL CLAIMS COURT CASES THAT QUALIFY, ANY DISPUTE THAT IN ANY WAY RELATES TO OR ARISES OUT OF THIS AGREEMENT OR FROM ANY EQUIPMENT, PRODUCTS AND SERVICES YOU RECEIVE FROM US (OR FROM ANY ADVERTISING FOR ANY SUCH PRODUCTS OR SERVICES), INCLUDING ANY DISPUTES YOU HAVE WITH OUR EMPLOYEES OR AGENTS, WILL BE RESOLVED BY ONE OR MORE NEUTRAL ARBITRATORS BEFORE THE AMERICAN ARBITRATION ASSOCIATION ("AAA") OR BETTER BUSINESS BUREAU ("BBB"). YOU CAN ALSO BRING ANY ISSUES YOU MAY HAVE TO THE ATTENTION OF FEDERAL, STATE, OR LOCAL GOVERNMENT AGENCIES, AND IF THE LAW ALLOWS, THEY CAN SEEK RELIEF AGAINST US FOR YOU.

(2) UNLESS YOU AND VERIZON WIRELESS AGREE OTHERWISE, THE ARBITRATION WILL TAKE PLACE IN THE COUNTY OF YOUR BILLING ADDRESS. FOR CLAIMS OVER $10,000, THE AAA'S WIRELESS INDUSTRY ARBITRATION ("WIA") RULES WILL APPLY. IN SUCH CASES, THE LOSER CAN ASK FOR A PANEL OF THREE NEW ARBITRATORS TO REVIEW THE AWARD. FOR CLAIMS OF $10,000 OR LESS, THE PARTY BRINGING THE CLAIM CAN CHOOSE EITHER THE AAA'S RULES FOR CONSUMER DISPUTES OR THE BBB'S RULES FOR BINDING ARBITRATION OR, ALTERNATIVELY, CAN BRING AN INDIVIDUAL ACTION IN SMALL CLAIMS COURT. YOU CAN GET PROCEDURES, RULES AND FEE INFORMATION FROM THE AAA (WWW.ADR.ORG), THE BBB (WWW.BBB.ORG) OR FROM US. FOR CLAIMS OF $10,000 OR LESS, YOU CAN CHOOSE WHETHER YOU'D LIKE THE ARBITRATION CARRIED OUT BASED ONLY ON DOCUMENTS SUBMITTED TO THE ARBITRATOR, OR BY A HEARING IN PERSON OR BY PHONE.

(3) THIS AGREEMENT DOESN'T ALLOW CLASS OR COLLECTIVE ARBITRATIONS EVEN IF THE AAA OR BBB PROCEDURES OR RULES WOULD. NOTWITHSTANDING ANY OTHER PROVISION OF THIS AGREEMENT, THE ARBITRATOR MAY AWARD MONEY OR INJUNCTIVE RELIEF ONLY IN FAVOR OF THE INDIVIDUAL PARTY SEEKING RELIEF AND ONLY TO THE EXTENT NECESSARY TO PROVIDE RELIEF WARRANTED BY THAT PARTY'S INDIVIDUAL CLAIM. NO CLASS OR REPRESENTATIVE OR PRIVATE ATTORNEY GENERAL THEORIES OF LIABILITY OR PRAYERS FOR RELIEF MAY BE MAINTAINED IN ANY ARBITRATION HELD UNDER THIS AGREEMENT. ANY QUESTION REGARDING THE ENFORCEABILITY OR INTERPRETATION OF THIS PARAGRAPH SHALL BE DECIDED BY A COURT AND NOT THE ARBITRATOR.

(4) IF EITHER OF US INTENDS TO SEEK ARBITRATION UNDER THIS AGREEMENT, THE PARTY SEEKING ARBITRATION MUST FIRST NOTIFY THE OTHER PARTY OF THE DISPUTE IN WRITING AT LEAST 30 DAYS IN ADVANCE OF INITIATING THE ARBITRATION. NOTICE TO VERIZON WIRELESS SHOULD BE SENT TO VERIZON WIRELESS DISPUTE RESOLUTION MANAGER, ONE VERIZON WAY, VC52N080, BASKING RIDGE, NJ 07920. THE NOTICE MUST DESCRIBE THE NATURE OF THE CLAIM AND THE RELIEF BEING SOUGHT. IF WE ARE UNABLE TO RESOLVE OUR DISPUTE WITHIN 30 DAYS, EITHER PARTY MAY THEN PROCEED TO FILE A CLAIM FOR ARBITRATION. WE'LL PAY ANY FILING FEE THAT THE AAA OR BBB CHARGES YOU FOR ARBITRATION OF THE DISPUTE. IF YOU PROVIDE US WITH SIGNED WRITTEN NOTICE THAT YOU CANNOT PAY THE FILING FEE, VERIZON WIRELESS WILL PAY THE FEE DIRECTLY TO THE AAA OR BBB. IF THAT ARBITRATION PROCEEDS, WE'LL ALSO PAY ANY ADMINISTRATIVE AND ARBITRATOR FEES CHARGED LATER, AS

WELL AS FOR ANY APPEAL TO A PANEL OF THREE NEW ARBITRATORS (IF THE ARBITRATION AWARD IS APPEALABLE UNDER THIS AGREEMENT).

(5) WE ALSO OFFER CUSTOMERS THE OPTION OF PARTICIPATING IN A FREE INTERNAL MEDIATION PROGRAM. THIS PROGRAM IS ENTIRELY VOLUNTARY AND DOES NOT AFFECT EITHER PARTY'S RIGHTS IN ANY OTHER ASPECT OF THESE DISPUTE RESOLUTION PROCEDURES. IN OUR VOLUNTARY MEDIATION PROGRAM, WE WILL ASSIGN AN EMPLOYEE WHO'S NOT DIRECTLY INVOLVED IN THE DISPUTE TO HELP BOTH SIDES REACH AN AGREEMENT. THAT PERSON HAS ALL THE RIGHTS AND PROTECTIONS OF A MEDIATOR AND THE PROCESS HAS ALL OF THE PROTECTIONS ASSOCIATED WITH MEDIATION. FOR EXAMPLE, NOTHING SAID IN THE MEDIATION CAN BE USED LATER IN AN ARBITRATION OR LAWSUIT. IF YOU'D LIKE TO KNOW MORE, PLEASE CONTACT US AT **VERIZONWIRELESS.COM** OR THROUGH CUSTOMER SERVICE. IF YOU'D LIKE TO START THE MEDIATION PROCESS, PLEASE GO TO **VERIZONWIRELESS.COM** OR CALL CUSTOMER SERVICE FOR A NOTICE OF DISPUTE FORM TO FILL OUT, AND MAIL, FAX OR EMAIL IT TO US ACCORDING TO THE DIRECTIONS ON THE FORM.

(6) WE MAY, BUT ARE NOT OBLIGATED TO, MAKE A WRITTEN SETTLEMENT OFFER ANYTIME BEFORE ARBITRATION BEGINS. THE AMOUNT OR TERMS OF ANY SETTLEMENT OFFER MAY NOT BE DISCLOSED TO THE ARBITRATOR UNTIL AFTER THE ARBITRATOR ISSUES AN AWARD ON THE CLAIM. IF YOU DON'T ACCEPT THE OFFER AND THE ARBITRATOR AWARDS YOU AN AMOUNT OF MONEY THAT'S MORE THAN OUR OFFER BUT LESS THAN $5,000, OR IF WE DON'T MAKE YOU AN OFFER, AND THE ARBITRATOR AWARDS YOU ANY AMOUNT OF MONEY BUT LESS THAN $5,000, THEN WE AGREE TO PAY YOU $5,000 INSTEAD OF THE AMOUNT AWARDED. IN THAT CASE WE ALSO AGREE TO PAY ANY REASONABLE ATTORNEYS' FEES AND EXPENSES, REGARDLESS OF WHETHER THE LAW REQUIRES IT FOR YOUR CASE. IF THE ARBITRATOR AWARDS YOU MORE THAN $5,000, THEN WE WILL PAY YOU THAT AMOUNT.

(7) AN ARBITRATION AWARD AND ANY JUDGMENT CONFIRMING IT APPLY ONLY TO THAT SPECIFIC CASE; IT CAN'T BE USED IN ANY OTHER CASE EXCEPT TO ENFORCE THE AWARD ITSELF.

(8) IF FOR SOME REASON THE PROHIBITION ON CLASS ARBITRATIONS SET FORTH IN SUBSECTION (3) CANNOT BE ENFORCED, THEN THE AGREEMENT TO ARBITRATE WILL NOT APPLY.

(9) IF FOR ANY REASON A CLAIM PROCEEDS IN COURT RATHER THAN THROUGH ARBITRATION, YOU AND VERIZON WIRELESS AGREE THAT THERE WILL NOT BE A JURY TRIAL. YOU AND VERIZON WIRELESS UNCONDITIONALLY WAIVE ANY RIGHT TO TRIAL BY JURY IN ANY ACTION, PROCEEDING OR COUNTERCLAIM ARISING OUT OF OR RELATING TO THIS AGREEMENT IN ANY WAY. IN THE EVENT OF LITIGATION, THIS PARAGRAPH MAY BE FILED TO SHOW A WRITTEN CONSENT TO A TRIAL BY THE COURT.

About this Agreement

If we don't enforce our rights under this Agreement in one instance, that doesn't mean we won't or can't enforce those rights in any other instance. You cannot assign this Agreement or any of your rights or duties under it without our permission. However, we may assign this Agreement or any debt you owe us without notifying you. **If you're a Postpay customer, please note that many notices we send to you will show up as messages on your monthly bill. If you have online billing, those notices will be deemed received by you when your online bill is available for viewing. If you get a paper bill, those notices will be deemed received by you three days after we mail the bill to you. If we send other notices to you, they will be considered received immediately if we send them to your wireless device, or to any email or fax number you've given us, or after three days if we mail them to your billing address. If you need to send notices to us, please send them to the customer service address on your latest bill.**

If you're a Prepaid customer and we send notices to you, they will be considered received immediately if we send them to your wireless device or to any email or fax number you've given us, or if we post them as a precall notification on your Service, or after three days if we mail them to the most current address we have for you. If you need to send notices to us, please send them to the Prepaid Customer Service address at verizonwireless.com/contactus

If any part of this Agreement, including anything regarding the arbitration process (except for the prohibition on class arbitrations as explained in part 8 of the dispute resolution section above), is ruled invalid, that part may be removed from this Agreement.

This Agreement and the documents it incorporates form the entire agreement between us. You can't rely on any other documents, or on what's said by any Sales or Customer Service Representatives, and you have no other rights regarding Service or this agreement. This agreement isn't for the benefit of any third party except our parent companies, affiliates, subsidiaries, agents, predecessors and successors in interest. Except where we've agreed otherwise elsewhere in this Agreement, this Agreement and any disputes covered by it are governed by federal law and the laws of the state encompassing the area code of your wireless phone number when you accepted this Agreement, without regard to the conflicts of laws and rules of that state.

Last Updated: 04/01/16

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Wireless Workshops

Register Signal Booster

Report A Security Vulnerability

Device Trade-In Program

Order Status

In-Store Pickup

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BlackBerry

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DECLARATION OF BOBBIE J. WILSON

EXHIBIT 22

(Redacted Version - Sought to be Sealed)

EXHIBIT 23

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 1              UNITED STATES DISTRICT COURT
               NORTHERN DISTRICT OF CALIFORNIA
 2                    SAN JOSE DIVISION

 3

 4   PATRICIA WEEKS, ALICIA HELMS, )
     BRIAN MCCLOY, and ADRIAN      )
 5   ALCARAZ, on behalf of         )
     themselves and all others     ) Case No.
 6   similarly situated,           ) 5:18-cv-00801-NC
                                   )
 7                  Plaintiff,     )
                                   )
 8          vs.                    )
                                   )
 9   GOOGLE LLC,                   )
                                   )
10                  Defendant.     )
     _____)
11

12

13


14    VIDEO-RECORDED DEPOSITION OF EXPERT STEFAN BOEDEKER

15                 Los Angeles, California

16             Thursday, December 20, 2018

17

18

19

20   Reported by:
     Shari Stellhorn
21   CSR No. 2807

22
     Job No. 3174578
23

24
     PAGES 1 - 104
25
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Page 1

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 1            UNITED STATES DISTRICT COURT
                NORTHERN DISTRICT OF CALIFORNIA
 2                   SAN JOSE DIVISION
 3
 4
      PATRICIA WEEKS, ALICIA HELMS, )
 5    BRIAN MCCLOY, and ADRIAN      )
      ALCARAZ, on behalf of         )
 6    themselves and all others     ) Case No.
      similarly situated,           ) 5:18-cv-00801-NC
 7                                  )
                        Plaintiff,  )
 8                                  )
               vs.                  )
 9                                  )
      GOOGLE LLC,                   )
10                                  )
                        Defendant.  )
11    _____)
12
13
14
15
16         Video-Recorded Deposition of STEFAN
17    BOEDEKER, taken on behalf of Defendant, at
18    1888 Century Park East, Suite 1700, Los Angeles,
19    California, beginning at 9:46 a.m. and ending at
20    12:29 p.m. on Thursday, December 20, 2018, before
21    Shari Stellhorn, Certified Shorthand Reporter No.
22    2807.
23
24
25
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                                                    Page 2

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 1   APPEARANCES:

 2

 3

 4   For Plaintiffs:

 5   GIRARD SHARP

 6   BY:   ADAM E. POLK, ESQ.

 7         SIMON S. GRILLE, ESQ.

 8   601 California Street, Suite 1400

 9   San Francisco, CA  94108

10   415.981.4800

11   apolk@girardsharp.com

12   sgrille@girardsharp.com

13

14

15

16   For Defendant:

17   PERKINS COIE LLP

18   BY:   PATRICK S. THOMPSON, ESQ.

19   505 Howard Street, Suite 1000

20   San Francisco, CA  94105-3204

21   415.344.7000

22   PatrickThompson@perkinscoie.com

23

24   Video Operator:  Richard Smith

25
```

Page 3

1   everybody, now that phone would sell for 550, not

2    $700.

3   Q   And so in your analysis -- we're using

4   hypothetical numbers -- but your analysis the price

5   premium would be the difference between the $700 and   11:25:38

6   the 550; is that correct?

7   A   I don't know if I would call it a price

8   premium. It's just a difference in price for an

9   otherwise identical phone that has a defect versus

10   one that doesn't have a defect.   11:25:54

11   If that's your definition for price

12   premium, then I go with that definition as a working

13   definition. It's a difference in prices and if --

14   in our example or in your hypothetical the market in

15   a sense has spoken that a phone with a microphone   11:26:12

16   defect is viewed inferior so the price would go

17   down, all right, and so the premium in this case --

18   if you want to use the word premium -- price premium

19   is the premium for having a phone with a

20   properly-working microphone.   11:26:27

21   Q   So let's consider the work that you've done

22   in the non-litigation context in pricing. If you

23   are doing a conjoint analysis, one of the things

24   that you might evaluate is whether consumers would

25   be willing to pay an extra $150 for a smartphone   11:26:46

Page 66

1   I declare under penalty of

2   perjury under the laws of the State of

3   California that the foregoing is true

4   and correct.

5   Executed on _____, 20___, at

6   _____, _____.

7

8

9

10   _____

11   EXPERT STEFAN BOEDEKER

12

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1   I, the undersigned, a Certified Shorthand
   Reporter of the State of California, do hereby
2   Certify:
         That the foregoing proceedings were taken
3   before me at the time and place herein set
         forth; that any witnesses in the foregoing
4   proceedings, prior to testifying, were
         administered an oath; that a record of the
5   proceedings was made by me using machine
         shorthand which was thereafter transcribed
6   under my direction; that the foregoing
         transcript is a true record of the
7   testimony given.
         Further, that if the foregoing pertains to
8   the original transcript of a deposition in
         a Federal Case, before completion of the
9   proceedings, review of the transcript [ ]
         was [X] was not requested. I further
10   certify I am neither financially
         interested in the action nor a relative or
11   employee of any attorney or any party to
         this action.
12

             IN WITNESS WHEREOF, I have this date
13   Subscribed my name.
14   Dated: December 30, 2018
15
16
17
18   _____
19   SHARI STELLHORN
         CSR No. 2807
20
21
22
23
24
25

                                         Page 104

DECLARATION OF BOBBIE J. WILSON

EXHIBIT 24

(Redacted Version - Sought to be Sealed)

**UNITED STATES DISTRICT COURT
NORTHERN DISTRICT OF CALIFORNIA
SAN JOSE DIVISION**

PATRICIA WEEKS, ALICIA HELMS, BRIAN MCCLOY, and ADRIAN ALCARAZ, on behalf of themselves and all others similarly situated,
 	
    Plaintiffs,
 	
  v.
 	
GOOGLE LLC,
 	
    Defendant.
	Case No. 5:18-cv-00801-NC

REBUTTAL REPORT OF DR. DENISE MARTIN

TABLE OF CONTENTS

I.   SUMMARY OF ASSIGNMENT AND OPINIONS

1.   Plaintiffs in the above-captioned matter allege that Google LLC ("Google" or "the Company") knew but failed to disclose that its first generation Pixel and Pixel XL cell phones, launched on October 20, 2016, were "prone to failure" and, when the risk manifested, "prevent[ed] consumers from communicating by voice call and from using features like Google Assistant."[1] I was asked by counsel for Google to evaluate the model proposed to estimate class-wide damages stemming from this alleged non-disclosure in the Expert Report of Stefan Boedeker in Support of Plaintiffs' Motion for Class Certification ("Boedeker Report").

2.   Mr. Boedeker proposes to conduct a conjoint analysis, asserting that its results can be used to estimate class-wide damages by measuring "the difference between the price paid and the price paid if customers had been told at the time and point of purchase about the Defect. Sometimes this difference is also referred to as a price premium."[2] Accepted economic theory and evidence indicate that Mr. Boedeker's assertion is wrong. His stylized survey of consumer preferences about certain attributes of cell phones is insufficient to identify and estimate the factors that drive product attributes, pricing, promotion, and sales in the market. Moreover, his proposed range of prices does not mirror those actually observed in the market by consumers at the point of sale. As such, his proposed conjoint analysis will not allow him to identify how prices would have changed—if at all—in the but-for world in which his alleged risk disclosure was made at the point of sale.

3.   The market for cell phones is complex. The structure of the market is one in which a few large firms, including Apple, Samsung and LG, are dominant.[3] Competition is intense due

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[1]   Second Amended Class Action Complaint, *Patricia Weeks, Alicia Helms, Brian McCloy, and Adrian Alcaraz on behalf of themselves and all others similarly situated, Plaintiffs v. Google LLC, Defendant*, United States District Court Northern District of California, Case No. 5:18-CV-00801-NC, September 24, 2018, ¶1.

[2]   Boedeker Report, ¶134.

[3]   "Manufacturers' market share of smartphone sales in the United States from 2016 to 2017", Statista, https://www.statista.com/statistics/620805/smartphone-sales-market-share-in-the-us-by-vendor/,   accessed January 11, 2019.

to the relatively small number of players, the vast size of the market (with sales of 174 million units with a value of $61 billion sold in the U.S. in 2017) and significant market penetration.[4] While sharing some basic functionality, the products offered by competing brands are differentiated by look, by size/weight and by features offered (including, *e.g.*, operating system, battery life, image resolution, memory capacity, and cameras). Given that differentiation, cell phone producers behave strategically with respect to branding, pricing and promoting their products, as well as with respect to what warranties they offer. In the parlance of economic theory, such markets are described as operating under "oligopolistic competition."[5]

        4.   ██

████████████████████████████████[6]██████████████████

██

████████████████████████████.[7] Economic theory and evidence suggests that companies in markets characterized by oligopolistic competition, like Google, set these prices considering, *e.g.*, their own costs, strategic plans, and market intelligence about the product offerings, pricing, and promotions of competitors.[8] At the retail level, additional strategic behavior is evident. Market intelligence collected by Google indicates that consumers purchase phones bundled together with cell service, use financing plans to pay monthly or annually, receive discounts for trade-ins, receive gifts with purchase and/or buy when other promotions are being offered.[9] Each of these pricing parameters is used strategically by retailers to drive sales. ██████████

██

██.[10]

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[4]   "Mobile Phones in the United States," Market Line Industry Profile, April 2018, p. 2.

[5]   See, *e.g.,* Mankiw, Gregory, *Principles of Microeconomics*, 7th Edition, 2014, Chapter 16-17.

[6]   Google LLC's Response to Plaintiffs' Priority Interrogatories, pp. 4-5.

[7]   *Ibid.*

[8]   See, *e.g.,* Mankiw, Gregory, *Principles of Microeconomics*, 7th Edition, 2014, Chapters 16-17.

[9]   See, *e.g.*, GOOG-WEEKS-00038851, 00038890, 00039037, 00039117, 00039198, 00039434, 00032460.

[10]   18141988 CONFIDENTIAL Pixel Sales data.xlsx (produced without Bates numbers by Verizon on July 27, 2018).

Similarly, analysis of Mr. Boedeker's pre-test survey data shows that over half of respondents who purchased an Android phone received a discount due to a promotion or trade-in, and/or financed/leased the device as part of a long term agreement.[11]

5.   To estimate the price that the Pixel products would have commanded had Mr. Boedeker's assumed risk disclosure been made at the time of sale requires a model that is sophisticated enough to incorporate these complexities. To be clear, a disclosure of the type posited by Mr. Boedeker would be unprecedented—to my knowledge, no cell phones are offered with a risk of defect indicated at the point of sale. To estimate a but-for market price, it is essential to apply a general equilibrium framework that models how behavior of consumers, cell phone producers and retailers would change. Given the complexities of the cell phone market and the nature of the assumed but-for disclosure in this matter, such modeling is critical because it is not clear that the price of the device itself would have adjusted *at all*. Instead, the terms of the warranty, the financing arrangements or various other promotional terms may have adjusted. Alternatively, all of the pricing terms and warranty terms may have remained the same and those consumers for whom the willingness to pay continued to be above the effective market price (taking into account, *e.g.,* the amount paid at the time of sale, trade-in discounts, financing arrangements and promotions such as free gifts and coupons for other items) would continue to buy, while any for whom the willingness to pay fell below the effective market price would have elected not to buy.

6.   The model that Mr. Boedeker proposes is *not* a sophisticated general equilibrium model. Instead, it is quite simplistic, taking into account none of the cell phone market complexities and ignoring the functioning of the market altogether. For example, his survey only offers respondents the choice of paying in a single payment for a standalone Pixel cell phone, when even his own pre-test survey data indicates that the majority of Android purchasers do not.[12] Similarly, ███ ███ Mr. Boedeker's presumed range of

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[11]   Iyengar Report, ¶¶49-50.

[12]   *Ibid.*

$550 to $950.[13] As noted, consumers also buy cell phones bundled with cell service, pay for the device over time and take advantage of trade-ins, discounts and other promotions. The change in consumers' willingness to pay resulting from the alleged risk disclosure would be expected to vary in these different situations and yet Mr. Boedeker's proposed model simply ignores these variations.

7.   In addition, in spite of the vigorous strategic competition evidenced in the market, Mr. Boedeker's proposed model effectively assumes that Google, its retailers and its competitors would have acted completely passively in the face of an unprecedented change in the marketing of the Pixel products. That is, he simply assumes that Google and its retailers would simply have lowered the price of the Pixel devices in the face of a purported decrease in the willingness to pay, rather than adjusting one of the other offered phone features, other pricing parameters or quantity. He further assumes that Google's competitors would not have changed their behavior in any way. Mr. Boedeker also ignores the existence of the warranties on the products, when economic theory indicates they are used to reassure consumers who have concerns about precisely the kind of risks he assumes should have been disclosed. He does not even consider the possibility that Google might have changed the terms of its warranty in the but-for world in which it was required to make his unprecedented risk disclosure. Instead of proposing a model that can address these market complexities, he asserts that he can estimate a "price premium" based solely on the difference in consumers' willingness to pay for the Pixel phones with and without the alleged risk disclosure estimated by his conjoint analysis.[14] Such an assertion is contradicted by economic theory, as well as the evidence in this case.

8.   He attempts to justify his limited focus on consumers by asserting that the supply side of the market would necessarily remain fixed in his but-for world; that is, he asserts that the but-for "price" should be determined by assuming that the same quantity of Pixels that was sold in the actual world must also be sold in the but-for world. This assumption is unnecessary and imposing it means Mr. Boedeker's proposed model cannot and will not estimate any price

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[13]   18141988 CONFIDENTIAL Pixel Sales data.xlsx (produced without Bates numbers by Verizon on July 27, 2018).

[14]   Boedeker Report, ¶134.

premium. Critically, in offering this purported justification, he is conflating two issues: which consumers would be entitled to receive any reliably-estimated price premium and how that premium should be estimated. Adhering to the principles of economics, estimating any price premium requires a model that can incorporate not just how consumers would have responded to the assumed risk disclosure but how Google, its competitors and its retailers would have responded; that is, such estimation requires that *the market* for the Pixel cell phones be modeled in the but-for world in which risk disclosure occurs at the point of sale. In the but-for world, Google could have adjusted any number of parameters, including the terms of the warranty, financing terms, terms of bundled cell service, trade-in values, promotional considerations such as free gifts and coupons offered for other accessories, and/or quantity. Its retailers could similarly have decided which of these parameters to adjust for their sales. Mr. Boedeker does not propose to model this market for Pixel phones, instead limiting his analysis to an estimated change in consumers' behavior, so does not and cannot estimate any price premium.

9.   As explained more fully in the Expert Report of Dr. Samantha Iyengar ("Iyengar Report"), Mr. Boedeker's proposed conjoint analysis otherwise suffers from flaws that will render even the estimated change in consumer behavior unreliable, including, *e.g.*:

    a) He provides vague descriptions of key terms, including "audio defect," "propensity to fail," and "defect rate." Participants will be left to make individualized assumptions about the specific allegations and there is no reason to expect they will be aligned with Plaintiffs' claims.[15]

    b) He provides no evidence that respondents will be able to understand and distinguish between the various "failure rates" he proposes. Instead, they are likely to resort to interpreting his key attribute as "defective" or "not defective." This interpretation is again not aligned with Plaintiffs' claims, which alleges some *risk* of defect that may or may not manifest. [16]

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[15]   Iyengar Report, ¶¶23-34.

[16]   *Ibid.*, ¶¶35-42.

c) He assumes all consumers pay in a single payment for their cell phones, failing to account for promotions, discounting due to trading in an older phone and/or payment made in monthly or annual installments. As a result, his survey will not realistically simulate their market experience so is unlikely to reliably reflect what their market choices would be.[17]

These and other issues with the design and implementation of his proposed survey will further render his estimates of the change in consumer behavior unreliable. This unreliability will flow directly through to his estimates of associated purported damages.

10.   Even if he could generate a reliable estimate of any price premium, Mr. Boedeker has not provided evidence that his proposed model could be used to generate class-wide damages.

a) He assumes that, at each point during the alleged class period, potential consumers could have been told that there was, *e.g.*, a 4.2 chance in 100 or 3-6% chance of a defect risk manifesting.[18] If a jury or finder of fact were to conclude that Google's knowledge about the issue was evolving over time and that it would not have been able to make such a precise disclosure and/or that what it could have disclosed would have been changing over time, Mr. Boedeker has put forward no method to estimate class-wide damages.

b) As noted, his proposed survey offers respondents choice sets in which they pay a full retail price between $550 and $950 for a standalone device at the point of sale. ██ ████████████████████████[19] Instead, they bought their phones bundled together with cell service, used financing plans to pay monthly or annually, received

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[17]   *Ibid.*, ¶49.

[18]   Boedeker Report, ¶112, Android Conjoint Draft Survey, p. 10.

[19]   18141988 CONFIDENTIAL Pixel Sales data.xlsx (produced without Bates numbers by Verizon on July 27, 2018).

discounts for trade-ins, received gifts with purchase and/or bought when other promotions were being offered.[20] Mr. Boedeker gives no indication of how he would estimate an implicit "full retail price" for the Pixel device in these multi-faceted transactions ███████████████████████████████████████ ██████████ so that he could multiply that figure by his percentage "price premium."

II.   QUALIFICATIONS

11.   I am a Managing Director at NERA Economic Consulting ("NERA") and have been with the firm since 1991.

12.   Before joining NERA, I earned a B.A. in Economics from Wellesley College and an M.A. and Ph.D., also in Economics, from Harvard University. My undergraduate and graduate education included coursework in microeconomics, statistics and econometrics, including both classical and Bayesian methods. Prior to attending Harvard, I served as an Assistant Economist at the Federal Reserve Bank of New York.

13.   While at Harvard, I taught classes in microeconomics, industrial organization and statistics to undergraduate and graduate students, and was awarded the Danforth Prize for Teaching. Microeconomics includes consumer theory, which explains how individuals make decisions, including which products to buy given the attributes embodied in them and the prices at which they are offered. Microeconomics also includes producer theory or industrial organization, which explains how firms make decisions, including what products to sell, with which attributes and at what prices.

14.   At NERA, I have been retained as an economic expert on more than 200 class actions, including consumer class actions, securities class actions and employment class actions. In the course of these assignments, I am frequently asked to analyze issues related to class certification and damages, including whether a formulaic method can be used to estimate damages on a class-wide basis. I regularly work with large datasets involving pricing and sales data. I

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[20]   See, *e.g.*, GOOG-WEEKS-00038873-00038874, 00039223-00039224, 0039345-00039346.

routinely use and have provided testimony regarding the application of statistical and econometric techniques, including conjoint analysis.

15.   My C.V., including my most recent 4 years of testimony and 10 years of publications, is included as **Exhibit A**.

16.   NERA is being compensated for my services in this matter at my standard rate of $950 per hour. Other NERA consultants and research staff assisted me in this engagement and NERA is being compensated for their services at rates ranging from $140 to $680 per hour. No part of NERA's compensation depends on the outcome of this litigation.

III.   MATERIALS CONSIDERED

17.   A complete list of the documents I considered in preparing this report is provided in **Exhibit B**.

IV.   SUMMARY OF MR. BOEDEKER'S PROPOSED DAMAGES APPROACH

18.   Mr. Boedeker opines that class-wide damages can be estimated by multiplying two factors: (1) his measure of the purported percentage "economic loss per unit" or percentage "price premium;" and (2) the price and number of challenged Pixel and Pixel XL units sold (*i.e.*, the dollar sales of the Pixel products).[21]

19.   His proposed method of estimating the "price premium" for the challenged products has five main steps:

    a) He will conduct a choice-based conjoint ("CBC") survey, in which he offers survey participants a set of product attributes and asks them to select the bundle they prefer, or to choose no bundle.[22] The product attributes he proposes to include are: [23]

        i. Battery life, with alternative "talk time" levels of 20 hours, 26 hours or 30 hours;

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[21]   Boedeker Report, ¶¶134-136.

[22]   *Ibid.*, ¶110.

[23]   *Ibid.*, ¶¶111-117.

ii.   Screen size, with alternatives of 5-inch (130 mm) AMOLED display panel with 1920x1080 resolution or 6-inch (150mm) P-OLED display panel with 2880x1440 resolution;

iii.   Rear camera, with alternatives of 12.2 megapixel capable of recording 4K video at 30 frames per second (FPS) or 18 megapixel capable of recording 4K video at 60 FPS;

iv.   Storage capacity, with alternatives of 64 or 128 gigabytes;

v.   Price, with alternatives ranging from $550 to $950; and

vi.   Risk of issues with phone's audio, defined in the Boedeker Report as: "User cannot make or receive phone calls without headphones, use the speakers, or use the voice-activated assistant feature"[24] and defined in the Android Draft Conjoint Survey as: "The phone suffers from a defect that causes the phone's microphones and audio to malfunction, preventing the user from reliably making or receiving phone calls, or using the phone's voice activated digital assistant, without using headphones, a Bluetooth device, or speakerphone. The audio defect can also result in speaker failure."[25]   Alternative manifestation rates are defined in the Boedeker Report as "No defect," "4.4 in 100 chance;" "6.8 in 100 chance;" or "9.2 in 100 chance"[26] and defined in the Android Conjoint Draft Survey as a likelihood of "No failures," "1-3%," "3-6%" or "6-9%."[27]

b)   He will use the results of his conjoint survey to estimate individual part-worths for each respondent for each attribute and each level.[28]

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[24]   *Ibid.*, ¶111.

[25]   Android Conjoint Draft Survey, p. 10.

[26]   Boedeker Report, ¶112.

[27]   Android Conjoint Draft Survey, p. 10.

[28]   Boedeker Report, ¶119.

c) He will construct demand curves for an unbranded smartphone in the "actual" and "but-for" world, which differ only in that the risk of manifestation of issues with the phone's audio are allegedly unknown in the "actual" world and known in the "but-for" world.[29]

d) He will compare his estimated demand curves to "[t]est if consumer demand shifts downward when the consumer knows about the Defect at the point of purchase, and quantify the drop, if the tests show a downward shift of the demand curve."[30]

e) He will conduct simulations to assess the "economic loss associated with the drop in demand when the consumers know about the Defect at the point of purchase."[31]

20.   In summarizing the anticipated output of his model, he asserts it will measure "the difference between the price paid and the price paid if customers had been told at the time and point of purchase about the Defect. Sometimes this difference is also referred to as a price premium."[32]

21.   Mr. Boedeker puts forward no description of how he would obtain or estimate the effective market price of the devices (taking into consideration, *e.g.,* trade-ins, bundling with service, financing plans and promotions) and therefore sales of the challenged Pixel products, the second component needed for his proposed damages measure.

V.   ANY MODEL USED TO ESTIMATE A PRICE PREMIUM MUST BE SOPHISTICATED ENOUGH TO INCORPORATE THE COMPLEXITIES OF THE CELL PHONE MARKET

A. Background on the Cell Phone Market

22.   The market for cell phones is complex. The structure of the market is one in which a few large firms are dominant, with other "fringe" players who account for a relatively small share

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[29]   *Ibid.*

[30]   *Ibid.*

[31]   *Ibid.*

[32]   Boedeker Report, ¶134.

of the market. Apple, Samsung and LG were collectively responsible for about 75% of smartphone sales in the U.S. in 2017, for example, with all other firms making up the remainder.[33] The size of the cell phone market is significant. In 2017, 174 million units were sold, yielding revenue of $61 billion.[34] 80% of potential consumers already own cell phones, however, and growth in the industry has slowed in recent years.[35] With the level of market penetration already so high, it is difficult for firms to increase sales by luring new customers into the market. Instead, any increase generally requires luring customers away from a competitor. As a result of these factors, competition in the cell phone market is vigorous.[36]

23.   The market is also characterized by a strong differentiation across products. While sharing some basic functionality, the cell phones offered by competing manufacturers are differentiated by look, by size/weight and by features offered (including, *e.g.*, operating system, battery life, image resolution, memory capacity, and cameras). According to economic theory, consumers choose between competing products with different attributes to maximize their overall utility or satisfaction, subject to budget constraints.[37]

24.   Given the market structure and product differentiation, cell phone producers behave strategically with respect to pricing and promoting their products, as well as with respect to what warranties they offer. In the parlance of economic theory, such markets are characterized as operating under "oligopolistic competition."[38]

25.   Pricing is not as simple as establishing that a 32GB Pixel will be sold for a price of $649, while a Pixel XL will be sold for $769. Instead, pricing in the cell phone market has several layers and multiple components. For example, while some consumers buy an unlocked cell phone

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[33]   "Manufacturers' market share of smartphone sales in the United States from 2016 to 2017", Statista, https://www.statista.com/statistics/620805/smartphone-sales-market-share-in-the-us-by-vendor/,   accessed January 11, 2019.

[34]   "Mobile Phones in the United States," Market Line Industry Profile, April 2018, p. 15.

[35]   *Ibid.*, p. 8.

[36]   *Ibid.*, p. 15.

[37]   See, *e.g.*, Mankiw, Gregory, *Principles of Microeconomics*, 7th Edition, 2014, Chapter 7.

[38]   *Ibid.,* Chapter 17.

(which can then be linked to any cellular service plan) and pay for the full retail price of the phone upfront, many consumers purchase their device in conjunction with a particular cellular service plan and choose to pay for their phone over time with the service.[39] In such cases, consumers effectively purchase a bundle of products and service, which may include the phone, phone accessories, service contracts that may be individual, for families or for businesses, as well as options to change the phone or plan in the future.[40]

26.   Economic theory and evidence indicate that companies operating in markets characterized by oligopolistic competition, such as Google, set wholesale and retail prices considering, *e.g.*, their own costs, strategic plans, and market intelligence about the offerings, pricing, and promotions of competitors.[41] ████████████████████████████████
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██████████████████████████████████[43] Except when sold through Google Store or Project Fi, though, Google did *not* set the actual retail prices that stores charged to consumers; that decision was ultimately made by each individual retailer. Of all first generation Pixel phones, 76% were sold via Verizon and other retailers.[44]

27.   The strategies subsequently used by Verizon and other retailers to set retail prices add another layer of complexity, as evidenced ████████████████████████████████
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[39]   See, *e.g.*, GOOG-WEEKS-00038851, 00038890, 00039037, 00039117, 00039198, 00039434, 00032460; McCloy Dep. at 106:19 – 111:24; Alcaraz Dep. at 73:3 – 74:2.

[40]   See, *e.g.*, Cell phone plans, bundles, and deals at Verizon's website: www.verizonwireless.com, accessed January 11, 2019.

[41]   See, *e.g.*, Mankiw, Gregory, *Principles of Microeconomics*, 7th Edition, 2014, Chapters 16-17.

[42]   Google LLC's Response to Plaintiffs' Priority Interrogatories, pp. 4-5.

[43]   See, *e.g.*, GOOG-WEEKS-00200111.

[44]   Google LLC's Response to Plaintiffs' Priority Interrogatories, pp. 4-5.

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[Redacted content]

[Redacted content].[45] [Redacted]

[Redacted content]

[Redacted content][6]

28.   These pricing and promotion comparisons reveal strategic interaction amongst retailers with respect to products of these manufacturers.[47]   Deals and promotions offered to consumers across these products included, *e.g.*, variations in:

a)   Phone service plans;

b)   Down payments for the phone;

c)   Monthly/annual payment plans for the phone;

d)   Credit for trade ins;

e)   Gift cards;

f)   Credits awarded for online purchase;

g)   Coupons for percentage or dollar amounts off accessory purchases;

h)   Free gifts with purchase; and

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[45]   See, *e.g.*, GOOG-WEEKS-00038845-00038848, 00038868-00038871, 00038905-00038908, 00038911-00038914, 00039133-00039136, 00039137-00039140, 00039360-00039363, 00039366-00039369, 00039387-00039390, 00039409-00039412, 00039413-00039416, 00039530-00039533, 00039552-00039555, 00039614-00039617.

[46]   See, *e.g.*, GOOG-WEEKS-00039116, 00039392, 00039535, 00039795, 00039810.

[47]   See, GOOG-WEEKS-00038872-00038888, 00038889-00038904, 00038915-00038932, 00038970-00039021, 00039022-00039035, 00039036-00039054, 00039055-00039114, 00039115-00039132, 00039141-00039194, 00039206-00039221, 00039222-00039327, 00039238-00039292, 00039293-00039343, 00039444-00039359, 00039370-00039386, 00039391-00039408, 00039417-00039432, 00039433-00039450, 00039451-00039504, 00039534-00039551, 00039556-00039613, 00039618-00039680, 00039681-00039737, 00039738-00039793, 00039794-00039808, 00039809-00039824, 00039826-00039889.

i)   Waived activation fees.

This evidence indicates that each of these alternative pricing/promotion parameters is used strategically by retailers to drive sales and, depending on their preferences, would have been factors considered by consumers when making purchase decisions.

29.   Warranties can serve as another point of differentiation in a competitive market. Empirically, cell phones are not 100% defect free, particularly shortly after launch. As a *Digital Trends* piece observes:

> All smartphones, especially newer ones, have their fair share of issues, bugs and glitches, from the unique to the familiar.[48]

A State of Mobile Device Repair & Security Report, released annually, reports failure rates by brand and model. Their Q4 2017 report observed that "failure rates (or the number of mobile phones that showed some sort of diagnostics issue during testing) were similar for Androids and iPhones" in North America, at 12 percent for iOS and a slightly lower percentage for Android, at 9 percent.[49]   Another report compared malfunction rates during the first 12 months after purchase, finding:

> Apple emerged as the most reliable manufacturer, with Motorola not far behind. We project fewer than 2.5% of iPhone and Motorola owners will report a malfunction in the first 12 months of use, with iPhone 4s leading the pack. HTC came next with a one-year malfunction rate of 3.7%, and BlackBerry's 6.3% was the highest of the four manufacturers examined. All

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[48]   Jansen, Mark and Steven Winkelman, "The Most Common Google Pixel Problems, and How to Fix Them," *Digital Trends,* August 14, 2018, www.digitaltrends.com/mobile/google-pixel-problems/, accessed December 13, 2018. Digital Trends is an online publication that provides reviews, editorials, and news about consumer technology products. Updates on issues being reported after launch are commonly made via such on-line publications. See, also, *e.g.*, "Samsung Galaxy S7 smartphones are vulnerable to hacking: Researchers," CNBC – Tech, August 8, 2018, https://www.cnbc.com/2018/08/08/samsung-galaxy-s7-smartphones-are-vulnerable-to-hacking-researchers.html, accessed January 18, 2019 (indicating microchip security issue with Galaxy S7 being reported after launch); and Spence, Ewan, "Apple Faces Massive Problems Over New iPhone Faults," Forbes, June 11, 2018, https://www.forbes.com/sites/ewanspence/2018/06/11/apple-iphone-iphone7-iphone7s-loopdisease-fault-broken/#1ad60f48f46a, accessed January 18, 2019 (indicating microphone and boot loop issue with iPhone 7 and 7 Plus being reported after launch).

[49]   "State of Mobile Device Repair & Security Report, Trend Report: Q4 2017," Blancco, February 2018, p. 8.

other smart phones taken together fared the worst, with 6.7% reporting a malfunction.[50]

30.   A branch of academic literature is devoted to the subject of new product warranties, describing how the risk of the manifestation of such issues post-launch are managed via warranty. This literature explains that warranties operate like insurance. Consumers are risk-averse and warranties provide assurance of repair, replacement or refund in the event of product failure:

> In the case of new products, another feature is that each new generation is more complex than the earlier generation it replaces. Often customers are uncertain about new product performance. Here warranties play an important role in providing product assurance to customers and different types of warranties are offered depending on the product and the buyer.[51]

31.   In the case of the Pixel, after a 15-day "remorse period" in which a monetary refund is automatically provided, the warranty offered repair, replacement or refund, at Google's discretion, for a period of one year from purchase.[52] A comparison of Google's warranty to that of Apple and Samsung, two of its primary competitors, shows that these companies offered similar warranties.[53] To the extent potential consumers were concerned about the risk of product defect, the existence and terms of such warranties is another attribute taken into consideration when making purchase decisions.

B.   Estimating a But-For Price Requires a General Equilibrium Model that Can Incorporate the Cell Phone Market Complexities

32.   Mr. Boedeker proposes to estimate the but-for price that the Pixel products would have commanded had his assumed risk disclosure been made at the point of sale. To properly

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[50]   "Smart Phone reliability: Apple iPhones with fewest failures, and major Android manufacturers not far behind," https://www.squaretrade.com/cell-phone-comparison-study-nov-10, accessed January 18, 2019.

[51]   Murthy, D.N.P., Djamaludin, I., "New Product Warranty: A Literature Review," *International Journal of Production Economics*, 79 (2002), 231-260, at 231-232.

[52]   Google Store Help: Hardware Warranty Center: https://support.google.com/store/troubleshooter/3070579#ts=7168940%2C7168941, accessed December 20, 2018.

[53]   Apple One (1) Year Limited Warranty, February 3, 2016 – July 12, 2018, https://www.apple.com/legal/warranty/products/ios-warranty-canada-english.html, accessed December 27, 2018. Samsung Terms & Conditions/Health & Safety Information, https://www.samsung.com/us/Legal/Phone-HSGuide/, accessed December 27, 2018.

estimate any but-for market price, it is essential to apply a general equilibrium framework that models how behavior of consumers, cell phone producers and retailers would change in the but-for world given the proposed additional disclosure. It is important here to observe that such a disclosure would be unprecedented: to my knowledge, no cell phones are offered with a risk of defect indicated at the point of sale. Further, while defect risks have manifested for other cell phone products at various rates following launch, Mr. Boedeker's proposed model assumes that only Google and retailers of the Pixel products would be required to make such a disclosure.

33.   Economic models designed to estimate such "but-for" market prices exist. Such models are used to analyze the competitive effects of mergers, for example, including whether pricing of a product would be affected by a merger. One set of tools, called "discrete choice models," can allow economists to model how changing one product attribute would affect both the demand for and supply of that product, generating an estimate of the but-for market price. Examples of these types of methodologies include the Random Coefficients Logit ("RCL") model, which is an empirical tool commonly used to apply the discrete choice modeling framework to observed market sales data of products.[54] A reliable model of this type would begin with a definition of the relevant market—here, *e.g.*, a determination of whether the market includes all cell phones, just smart phones, or just high-end smart phones. Empirical analysis is required to make such a determination. Within a relevant market, the market equilibrium is characterized by a set of quantities sold of particular products/brands, with a set of attributes, at equilibrium prices. Rather than considering only how changes to a product attribute might affect consumer preferences, the goal of such models is to estimate how changes in product attributes affect *sales* of the product by taking into account the impact on consumers, *as well as producers and retailers*. [55]

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[54]   This approach was popularized by a 1995 article by Berry, Levinsohn and Pakes that applied the technique to the market for automobiles in the United States. See, Berry, S., J. Levinsohn, and A. Pakes. 1995. "Automobile Prices in Market Equilibrium." *Econometrica* 63: 841-890. See, also, e.g., Nevo, A. 2011. "Empirical Models of Consumer Behavior." *Annual Review of Economics* 3: 51-75.

[55]   See, *e.g.*, Nevo, A. "A Practitioner's Guide to Estimation of Random-Coefficients Logit Models of Demands," *Journal of Economics & Management Strategy*, Volume 9, Number 4, Winter 2000, 513-548. In addition to sales for the product in question, use of such models also requires data and analysis of sales/market shares for other products in the market.

34.   While proper application of such models to reliable data can provide a prediction about the impact on price of a change in a product attributes, such a model will only tell a portion of the story given strategic behavior by other firms in the market. If a change in demand has an impact on the price offered by one firm, its competitors may respond by changing the price of their own products until a new equilibrium is reached. To estimate market equilibrium prices in such circumstances, an economic model of competition among suppliers should therefore also be developed.[56] In the cell phone market, for example, empirical ████████████████████

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████████████████████████████.[57] Further, many of the large players sell more than just phones—some sell subscription services and other hardware. Cross-marketing across these product lines may affect pricing decisions and should be taken into account. Any model should also incorporate the fact that producer choices will be affected by costs and supply chain processes, which may be subject to constraints (*e.g.*, only so many units of a particular product can be produced per month). It is important that dynamics such as these be factored into a model that seeks to estimate a but-for equilibrium.

35.   Given these market complexities, sophisticated modeling is critical because it is not obvious that the price of the device itself would have adjusted *at all*. To the extent the willingness to pay of some consumers was reduced on account of the risk disclosure, Google may have elected to offer refund, repair or replacement services beyond the one-year period of the Limited Warranty, thereby increasing its own costs of servicing the warranty. Alternatively, the financing arrangements or various other promotional terms may have adjusted to be more favorable, with higher discounts offered for trade-ins, *e.g.*, or coupons for other items increased.

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[56]   A good model of competition requires an economist to collect information—or at least to make explicit assumptions—on factors such as the nature of competition between firms (*e.g.*, whether firms compete on price, quality, advertising, or other factors), the current costs of each firm and how these costs vary with output, and whether changes in prices would provide incentives for new firms to enter the market or for existing firms to exit the market.

[57]   For example, ██

████████████████████████████████. See, *e.g.*, GOOG-WEEKS-00039116, 00039392, 00039535, 00039795, 00039810.

36.   Another possibility is that all of the warranty and pricing terms may have remained the same and certain consumers may simply have elected not to buy. That is, if a consumer's prior expectation regarding the risk of an issue with the microphone were materially different than the estimate Google allegedly should have provided at the point of sale and if the consumer was unwilling to trust that Google's servicing of the warranty would be satisfactory should an issue arise, his or her willingness to pay might fall below the effective market price (taking into consideration, *e.g.,* trade-ins, bundling with service, financing plans and promotions). If so, that consumer would have elected not to purchase. In the but-for world with the assumed risk disclosure, then, there may have been a change in *quantity,* rather than change in price.

37.   In that situation, those consumers who would not have purchased with the assumed risk disclosure might be entitled to economic damages that are the difference between the effective price paid and any value received. The latter value would depend on, *e.g.,* whether the consumer experienced a defect and, if so, the length of time before such defect occurred. Identifying those consumers who would not have purchased with the but-for risk disclosure, as well as estimating any value received, would necessarily require individualized review.

38.   Importantly, though, in this situation, those consumers who would have continued to purchase at the same price would have been *unharmed.* That is, if quantity would have adjusted rather than price, those consumers whose willingness to pay for the Pixel would have remained above the market price would have continued to purchase at the same price. As such, no compensation would be required to return them to the financial situation they would have held absent the alleged wrongdoing.

39.   In sum, estimating how the price for the Pixel products would have changed in the but-for world requires empirical analyses and application of sophisticated economic models in a general equilibrium framework that takes into account how the behavior of consumers, Google, its retailers and competitors would have responded. As explained below, Mr. Boedeker fails to conduct any empirical analysis or modeling of the cell phone market, the drivers of supply and pricing, or market competition.

VI.   **MR. BOEDEKER'S USE OF A SIMPLISTIC MODEL CANNOT INCORPORATE THE COMPLEXITIES OF PRICING AND PROMOTION IN THE CELL PHONE MARKET**

A.   **Mr. Boedeker's Proposed Conjoint Analysis Does Not Incorporate Any of the Cell Phone Market Complexities, Instead Looking Only at Consumers' Willingness to Pay**

40.   The model that Mr. Boedeker proposes—conjoint analysis—does not estimate but-for product attributes, prices, promotions and sales in a general equilibrium framework. Instead, it is very simplistic, at best estimating how only one set of market participants—consumers—would have responded in the but-for world in which the assumed risk disclosure was made at the point of sale. His proposed model would not consider how other market participants, including Google, its retailers and competitors, would have responded to an unprecedented disclosure of this type.

41.   Given its limited focus, conjoint analysis is simply not designed to estimate a but-for price. It is important to understand that the limitations of Mr. Boedeker's proposed approach are not a matter of opinion. Every treatise I have seen on conjoint analysis—including those referenced by Mr. Boedeker—describes the output as a measure of willingness to pay, expressly cautioning it cannot be used to estimate market prices.

42.   Dr. Greg Allenby, an accepted academic authority in conjoint analysis makes this point clearly, cautioning:

> [A] conjoint survey, in and of itself is not adequate to form the basis for equilibrium firm profit calculations. Not only must we calibrate demand for products, but we must also compute industry equilibria. This requires measures of costs, a demand system not only for the focal product but also for the major competing products, and an equilibrium concept.[58]

> [T]he WTP [(willingness to pay)] … cannot be [a] measure[] of the market value of a product feature….   The WTP… measure[] utilize[s] only

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[58]   Allenby, Greg, Jeff Brazell, John R. Howell, and Peter E. Rossi, "Valuation of Patented Product Features." *Journal of Law and Economics*, Vol. 57, No. 3, 2014, p. 630.

demand-side information and [is] independent of costs or the competitive structure of the industry....[59]

WTP... [is] purely demand-based...and [does] not take into account changes in prices and costs as the feature is enhanced and a new industry equilibrium is achieved.[60]

43.   Dr. Allenby further explains that conjoint analysis cannot generate a reliable estimate of a but-for market price premium without analysis of the supply side of the market, noting, "it is important to remember that consumer valuations of [a] misrepresented feature are not the same as the market price premium associated with the alleged misrepresentation." Conjoint surveys "do not take into account cost and other market forces such as the nature of competition among suppliers," and therefore a price premium "cannot be determined by consumers' valuation of the accused feature alone."[61]

44.   Treatises used by practitioners of conjoint surveys make this same point, clearly stating this limitation and cautioning against trying to use the tool to predict market shares and price sensitivity to particular product attributes:

> [C]onjoint utilities cannot account for many real world factors that shape market shares, such as length of time on the market, distribution, out-of-stock conditions, advertising, effectiveness of sales force, and awareness. Conjoint analysis predictions also assume that all relevant attributes that influence share have been measured. Therefore, the share of preference predictions usually should not be interpreted as market shares, but as relative indications of preference. Divorcing oneself from the idea that conjoint simulations predict market shares is one of the most important steps to getting value from a conjoint analysis study and the resulting simulator. While external-effect factors can be built into the simulation model to tune conjoint shares of preference to match market shares, we suggest avoiding this temptation if at all possible. No matter how carefully

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[59]   *Ibid.*, p. 647, p. 649.

[60]   *Ibid.*, p. 650.

[61]   Allenby, Greg, Peter E. Rossi, Lisa Cameron, and Yikang Li, "Computing Damages in Products Mislabeling Cases: Plaintiffs' Mistaken Approach in *Briseno v. ConAgra*," 45, *Products Safety & Liability Reporter*, 208, 2017.

conjoint predictions are calibrated to the market, the researcher may one day be embarrassed by differences that remain.[62]

45.   The manual for Sawtooth Software, which Mr. Boedeker testified he would use to generate his estimates, similarly explains:

A market simulator lets you input multiple products and place them in simulated competition one with another…The choice simulator focuses on the *demand of the marketing equation.*[63]

46.   The very limitations expressed in these treatises are evident in Mr. Boedeker's conjoint analysis. For example:

a) His simplistic survey only offers respondents choice sets that include paying in full at the point of sale for a standalone Pixel cell phone, when the market reality is that many do not. Analysis of Mr. Boedeker's own pre-test data show that 51% of Android consumers did not pay the full retail price in a single payment at the point of sale.[64] The ██████████████████████████████████ ███ ███████████████.[65] Further, as evidenced in the market intelligence collected by Google, as well as in Mr. Boedeker's pre-test results, consumers buy cell phones bundled with cell service, pay for the device over time and take advantage of trade-ins, discounts, free gifts and other promotions.[66]

b) In spite of the vigorous strategic competition evidenced in the market for cell phones, with, for example, Google actively monitoring the prices, promotions,

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[62]   Orme, B.K. *Getting Started with Conjoint Analysis: Strategies for Product Design and Pricing Research*, 3rd Edition, Research Publishers LLC, 2014, p. 108.

[63]   See, Sawtooth Software's website at https://www.sawtoothsoftware.com/help/lighthouse-studio/manual/index html?hid_typicalquestions html, accessed December 27, 2018, *emphasis added*.

[64]   Iyengar Report, ¶49.

[65]   18141988 CONFIDENTIAL Pixel Sales data.xlsx (produced without Bates numbers by Verizon on July 27, 2018).

[66]   See, *e.g.*, GOOG-WEEKS-00038851, 00038890, 00039037, 00039117, 00039198, 00039434, 00032460.

product availability and product placement of its phones versus those of its competitors, Mr. Boedeker's proposed model effectively assumes that Google, its retailers and its competitors would have acted completely passively in the face of an unprecedented change in the marketing of the Pixel products.[67]   Rather than acknowledging that the reaction of Google and its retailers to the assumed risk disclosure would have been strategic, he assumes they simply would have lowered price in response to any estimated decrease in consumers' willingness to pay. In reality, a number of parameters were available and could have been adjusted instead of or in addition to adjusting the price of the Pixel device. For example, Google and its retailers may have elected to adjust the financing terms, trade-in values, free gifts with purchase or other promotions. Alternatively, they may not have responded at all in the pricing space, choosing for strategic reasons ███████████████████

████████████████, *e.g.*, and keeping other promotional parameters as they were.[68] Instead, they may have elected to lose sales to those consumers for whom the willingness to pay in the but-for world with a risk disclosure would have fallen below the effective market price.

c) Mr. Boedeker's simplistic proposed model also ignores the existence of the warranties on the products and the possibility that the terms of the warranty might have adjusted in his but-for world, rather than price. For example, rather than lowering the price of the device, Google may have offered refund, repair or replacement services beyond the one-year period of the Limited Warranty, thereby increasing its own costs of servicing the warranty. Failing to consider the possibility of such a response is a critical flaw. Economic theory indicates warranties are used to reassure consumers who have concerns about precisely the kind of risks Mr. Boedeker assumes should have been disclosed.

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[67]   See, intelligence reports regularly generated by Google including "Google Pixel Consumer Pricing and Tariffs," "Google Pixel Consumers Offers Online" and "Key Online Highlights," *e.g.*, GOOG-WEEKS-00038851, 00038890, 00039037, 00039117, 00039198, 00039434, 00032460.

[68]   See, *e.g.*, GOOG-WEEKS-00039392, 00039535, 00039795, 00039810.

47.   Contrary to Mr. Boedeker's simplistic model and embedded assumptions, the evidence shows that Google, its retailers and competitors had sophisticated pricing, promotion, sales and warranty strategies and would have been expected to update these strategies in the face of any material change in the behavior of consumers.   Because Mr. Boedeker's model fails to incorporate the change in the behavior of these other market participants, he cannot estimate the but-for price for the Pixel or Pixel XL.

B. Mr. Boedeker's Justification for Failing to Model the Market for Pixel Phones is Unfounded

48.   Mr. Boedeker attempts to justify his limited focus on the change in consumer behavior by asserting that the supply side of the market would necessarily remain fixed in his but-for world.   That is, he asserts that the but-for "price" should be determined by assuming that the same quantity of Pixels that was sold in the actual world must also be sold in the but-for world. For all of the reasons described above, imposing this assumption and thereby ignoring the response of other market participants to the assumed risk disclosure means Mr. Boedeker's proposed model cannot and will not estimate any price premium.   Moreover, imposing such an assumption is unnecessary.   In offering his purported justification for assuming static behavior by all market participants other than consumers, Mr. Boedeker is conflating two issues: which consumers would be entitled to receive any estimated price premium and how that price premium should be measured.

49.   Adhering to the principles of economics, estimating any price premium requires a model that can incorporate not just how *consumers* would have responded to the assumed risk disclosure, as Mr. Boedeker's proposed model purports to do, but how *Google, its retailers and its competitors* would have responded.   Doing such estimation properly requires application of a model that would allow all market parameters, including the terms of the warranty, financing terms, terms of bundled cell service, trade-in values, promotional considerations such as free gifts and coupons offered for other accessories, and/or quantity.   That is, the estimation of a but-for equilibrium price and, therefore, any price premium requires that *the market* for the Pixel cell phones in the but-for world be modeled.   It is only through development of such a rigorous model that any price premium could be reliably estimated.

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50.   By proposing a model that considers only the change in consumer behavior, Mr. Boedeker effectively pre-supposes his answer. If his model estimates a reduction in the willingness to pay, he will necessarily conclude that the but-for price would have been reduced and all consumers were damaged. Instead, as explained above, the price of the device may not have changed in the but-for world, making price premium damages an inappropriate remedy from the perspective of economics. It is only through application of a general equilibrium model that incorporates the responses of all market participants that it would be possible to evaluate whether any price premium existed.

C.   The Conjoint Analysis Proposed by Mr. Boedeker Will Not Reliably Estimate Even the Response of Consumers

51.   As explained more fully in the Iyengar Report, Mr. Boedeker's proposed conjoint analysis otherwise suffers from flaws that will render even his estimates of the response of consumers (*i.e.*, the willingness to pay estimates) unreliable. Critical flaws include, *e.g.*:

a)   He offers vague descriptions of key terms, including "audio defect," "propensity to fail," and "defect rate." Participants will be left to make individualized assumptions about the specific allegations and there is no reason to expect they will be aligned with Plaintiffs' claims.[69]

b)   He provides no evidence that respondents will be able to understand and distinguish between the various "failure rates" he proposes and, instead, they are likely to resort to interpreting his key attribute as "defective" or "not defective." This interpretation is again not aligned with Plaintiffs' claims, which instead alleges some risk of defect.[70] Moreover, as noted above, empirically, cell phones are not 100% free from risk of defect.

c)   He assumes that all consumers pay full price for their cell phones, failing to account for promotions (including free gifts and coupons for other items), discounting due

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[69]   Iyengar Report, ¶¶23-34.

[70]   *Ibid.*, ¶¶35-42.

to trading in an older phone and/or payment made in monthly or annual installments.[71]   As a result, his survey will not realistically simulate their market experience so is unlikely to reliably reflect what their market choices would be.[72]

52.   These and other issues with the design and implementation of his proposed survey will render his estimates of purported willingness to pay additionally unreliable. This unreliability will flow directly through to his estimate of the associated purported "price premium" damages.

VII.   Even if He Could Generate a Reliable Estimate of Any "Price Premium," No Evidence Exists That Mr. Boedeker's Model Could Estimate Class-wide Damages

53.   Even if he could generate a reliable estimate of any "price premium," Mr. Boedeker has not explained how he would apply this estimate to sales of first generation Pixel products to estimate class-wide damages.

54.   First, he assumes that, at each point during the alleged class period, potential consumers could have been told that there was, *e.g.*, a 4.2 chance in 100 or 3-6% chance of a defect risk manifesting. Internal documents provide evidence of an on-going investigation into reported issues and an evolution of knowledge about these issues.[73]   If a jury or finder of fact were to conclude that Google's knowledge about the issues was evolving over time and that it would not have been able to make such a precise disclosure and/or that the nature of what it could have

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[71]   *Ibid.*, ¶¶49-50.

[72]   *Ibid.*, ¶49.

[73]   GOOG-WEEKS-00000114 00000119, 00000610-00000621, 00000622-00000638, 00000639-00000659, 00000660-00000686, 00002663-00002671, 00002672-00002681, 00003887-00003893, 00005617-00005630, 00005683-00005686, 00008953-00008975, 00009625-00009644, 00009807, 00011802-00011812, 00013366-00013421, 00021852-00021856, 00021889-00021893, 00022253-00022258, 00012929-00012951, 00019336-00019352, 00007497-00007526, 00023022-00023047, 00021566-00021574, 00010557-00010580, 00013217-00013233, 00015866-00015881, 00013234-00013255, 00010646-00010668, 00023503-00023536, 00016075-00016091, 00023089-00023104, 00018643-00018659, 00018711-00018727, 00014502-00014518, 00015789-00015805, 00012331-00012353, 00016093-00016108, 00015383-00015398, 00012046-00012067, 00011758-00011784, 00006864-00006887, 00011564-00011586, 00010769-00010780, 00010369-00010391, 00011629-00011651, 00010673-00010695, 00011587-00011608, 00007724-00007749, 00010500-00010524, 00010280-00010303, 00005787-00005809, 00010669-00010671, 00009625-00009644, 00008748-00008774, 00009498-00009524, 00008721-00008747, 00004338-00004360, 00006218-00006237, 00009553-00009576, 00009322-00009341, 00006889, 00004902-00004909, 00006890-00006915, 00007468-00007496, 00003577-00003596, 00000622-00000638, 00003064-00003078, 00007607-00007609, 00002562-00002576, 00003185-00003203, 00002503-00002516, 00003384-00003400, 00003041-00003063, 00003024-00003040, 00002522-00002535.

disclosed would have been changing over time, Mr. Boedeker has put forward no method to estimate class-wide damages.

55.   In addition, given the pronounced variability in the effective market prices that consumers actually pay for the Pixel products, including bundling with service, monthly payment plans, discounts, rebates, credit for phones traded in, gifts with purchase and coupons for other products, Mr. Boedeker's conjoint survey, estimated offering standalone cell phones at full retail prices that range from $550 to $950, will in no way cover the range of pricing and promotion that consumers actually experience. ████████████████████████████████ ██ ██████████████████████[74] While Mr. Boedeker indicates he will multiply his percentage "price premium" by the price of units sold, doing so using the Verizon data would clearly not yield a reliable estimate of any class-wide damages. Moreover, further analysis of his pre-test survey data shows, similarly, that over half of respondents who purchased an Android phone did not purchase it at full retail price in a single payment and, instead, received a discount due to a trade-in or promotion, and/or financed/leased the device as part of a long term agreement.[75] Mr. Boedeker has put forward no methodology to identify the total value of the bundled products/services purchased by the consumer, nor to then decompose this value into the amount associated only with the allegedly defective Pixel product so that his estimated percentage "price premium" could be applied.

56.   As an illustration, suppose Consumer A paid $649 in a single payment for a Pixel phone from Google Store, while Consumer B paid $0 at the point of sale and would pay $25/month for two years (for a total of $600), received a discounted monthly payment plan for a three-year cell service plan with a phone upgrade possible after two years, and received a coupon for 30% off a Virtual Reality headset. Mr. Boedeker's model only even purports to estimate the change in the willingness to pay for Consumer A; he is silent about how his proposed model would estimate damages to Consumer B or any putative class member who bought at terms different than his

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[74]   18141988 CONFIDENTIAL Pixel Sales data.xlsx (produced without Bates numbers by Verizon on July 27, 2018).

[75]   Iyengar Report, ¶¶49-50.

simplistic assumed full retail price. Moreover, for those consumers paying over time, full payment for the device may not yet have occurred and, if the phone was traded in for a new Pixel, may never occur. Mr. Boedeker does not indicate how he will address these issues.

VIII.   CONCLUSION

57.   Mr. Boedeker's proposed conjoint analysis will not generate a reliable estimate of any individual or class-wide damages in this matter for a number of reasons:
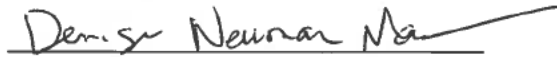
a) The complexities in the market for cell phones cannot be incorporated into his simplistic conjoint framework, which considers only how consumer behavior might change in the but-for world with the assumed risk disclosure at the point of sale. It does not consider how the behavior of other market participants, including Google, its retailers and its competitors would change. Without incorporating the responses of these other market participants, his model cannot and will not estimate any price premium associated with the alleged non-disclosure of risk. Mr. Boedeker's assertion that the behavior of these other market participants needs to be fixed because quantity sold needs to be fixed at historical levels is based on his conflation of the issues of who would be entitled to receive any price premium damages and how any such price premium should be measured.

b) The proposed design and implementation of his survey are also badly flawed. For example, it is unlikely that respondents will be able to understand and distinguish between the various "failure rates" he proposes and, instead, they are likely to resort to interpreting his key attribute as "defective" or "not defective." This interpretation is not aligned with Plaintiffs' claims, which instead alleges some risk of defect. Given this and other flaws, even his estimated change in consumers' willingness to pay will be unreliable. These flaws will flow directly through to his estimated "price premium" damages, rendering them additionally unreliable.

c) Given the complexities of strategic pricing and promotion in the market at hand, Mr. Boedeker has not articulated how his simplistic purported "price premium"— estimated assuming a standalone phone is purchased at full retail value—could be applied to sales that include phones bought bundled with discounted cell service, at

times of various promotions including free gifts and coupons for discounts off other products, and/or that are paid for over time. ███████████████████████

███████████████████████████████ ███ ██████████

███████████████████████████████████████ Mr. Boedeker is silent about how his percentage "price premium" would be applied to these purchases to estimate class-wide damages. Analysis of Mr. Boedeker's pre-test survey data shows, similarly, that over half of respondents who purchased an Android phone received a discount due to a trade-in or promotion, received free gifts or coupons for other items, and/or financed/leased their phone as part of a long-term agreement.[76] Mr. Boedeker does not explain whether he could or how he would estimate the effective market price for the Pixel device in such purchases so that his percentage "price premium" estimate could be applied.

* * * * * * *

58.   My work in this matter is ongoing. I reserve the right to update or modify the opinions expressed above if additional information becomes available to me.

Denise Neumann Martin

Denise Neumann Martin, 1/23/2019

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[76]   Iyengar Report, ¶¶49-50.

NERA
ECONOMIC CONSULTING

National Economic Research Associates, Inc.
1166 Avenue of the Americas
New York, New York 10036
+1 212 345 3000 Fax +1 212 345 4650
Direct dial: +1 212 345 5296
denise.martin@nera.com
www.nera.com

Exhibit A

DENISE NEUMANN MARTIN
Managing Director

Education

Harvard University
Ph.D., Economics, 1991
M.A., Economics, 1988

Wellesley College
B.A., *magna cum laude*, Economics and French, 1985
Honors: Phi Beta Kappa

Professional Experience

NERA Economic Consulting

2001-	Managing Director
1998-2000	Vice President
1994-1997	Senior Consultant
1991-1993	Senior Analyst

Harvard University

1986-1990   Teaching Fellow, Department of Economics
Taught courses in Microeconomics and Industrial Organization at the graduate and undergraduate levels. Assisted senior honors candidates with theses. Awarded Danforth Prize in Teaching.

1986-1990   Research Associate, Department of Economics
Projects included an investigation of the timing of international horizontal mergers, an evaluation of the effect of generic entry into the pharmaceutical market, and a comparison of technical efficiency across countries.

Urban Systems Research and Engineering/Economica, Inc.

1987-1988   Economic Consultant
Consulted on all aspects of government agency projects, including proposals and the design of survey instruments. Provided economic forecasts and technical support.

Federal Reserve Bank of New York

1985-1986   Assistant Economist, International Financial Markets
Analyzed Eurobond markets, interest rate swap markets, and US commercial banks' balance sheets.

Testimony (4 years)

Reply Declaration, Deposition Testimony and Rebuttal Declaration before the United States District Court for the Southern District of New York in *Suzanna Bowling, et al. v. Johnson & Johnson and McNeil Nutritionals, LLC*, 2018.

Rebuttal and Expert Reports before the United States District Court Central District of California, Western Division in *Oaktree Principal Fund V, LP., et al. v. Warburg Pincus LLC, et al.*, 2018.

Deposition Testimony and Expert Report before the United States District Court Northern District California in *Colleen Gallagher et al., v. Bayer AG, Bayer Corporation, and Bayer Healthcare LLC*, 2018.

Deposition Testimony before the Alameda County Superior Court in *Stephen M. Snyder, Jack L. Luikart, and Sandra R. Hernandez, solely in their capacities as trustees of the Western Asbestos Settlement Trust v. California Insurance Guarantee Association.* 2018.

Rebuttal Declaration before the United States District Court for the Northern District of California in *Jackie Fitzhenry-Russell v. The Coca Cola Company; and DOES 1-10, and DOES 1-50,* 2018.

Rebuttal Report before the United States District Court Central District of California in *David Spacone v. Elmer's Products, Inc., a Delaware Corporation; and DOES 1-10, inclusive*, 2018.

Deposition, Rebuttal Report and Declaration before the United States District Court Central District of California, in *Stephen Wilson v. Odwalla, Inc., a California Corporation; The Coca Cola Company, a Delaware Corporation; and DOES 1-10, inclusive*, 2018.

Testimony, Deposition and Rebuttal Report before the United States District Court Southern District of New York, in *Effat S. Emamian v. Rockefeller University*, 2018.

Deposition, Rebuttal and Supplemental Declarations before the U.S. District Court, Northern District of California in *Preston Jones and Shirin Delalat, et al. v. Nutiva, Inc.*, 2017/2018.

Supplemental and Rebuttal Declarations before the United States District Court Eastern District of California in *Joann Martinelli, et al. v. Johnson & Johnson and McNeil Nutritionals,* LLC, 2017/2018.

Rebuttal Declaration before the United States District Court Southern District of New York in *Jaish Markos, et al., v. Russell Brands, LLC*, 2018.

Affidavit before the Ontario Superior Court of Justice in *Dara Fresco vs. Canadian Imperial Bank of Commerce*, 2017.

Testimony, Deposition and Expert Reports before the Circuit Court of Cook County, Illinois County Department, Chancery Division in *John Crane, Inc. v. Allianz, et al.*, 2015/2016/2017.

Deposition and Declaration before the United States Court District of South Carolina Greenville Division in *Myriam Fejzulai and Monica Moore, et al. v. Sam's West, Inc.; Sam's East Inc.; and Wal-Mart Stores, Inc.*, 2017.

Declaration and Deposition before the United States Court Central District of California in *Morgan Chikosi, et al. v. Sam's West, Inc.; Sam's East Inc.; and Wal-Mart Stores, Inc.,* 2017.

Rebuttal Reports before the United States District Court Western District of Missouri, Western Division in *In Re: Simply Orange, Orange Juice Marketing & Sales Practices Litigation*, 2016.

Expert Report and Declarations before the United States District Court for the Northern District of California in *Senne, et al. vs. Office of the Commissioner of Baseball, et al*., 2016.

Expert Report before the Superior Court of the State of California County of Santa Clara, in *In Re: FireEye, Inc. Securities Litigation*, 2016.

Affidavit before the State of Wisconsin Circuit Court Milwaukee County in *Harley-Davidson, Inc., v. Hartford Accident and Indemnity Company, et al.*, 2016.

Deposition and Rebuttal Report before the United States District Court Northern District of Ohio Eastern Division in *Christopher Meta, et al. v. Target Corporation, et al.*, 2016.

Deposition, Rebuttal Declaration and Declaration before the United States District Court for the Central District of California Western Division in *In Re NJOY, Inc. Consumer Class Action Litigation*, 2015/2016.

Deposition and Expert Report before the Court of Common Pleas of Lucas County Ohio in *Certain Underwriters at Lloyd's London, et al. v. Allstate Insurance Co., et al.*, 2015.

Deposition, Expert, Supplemental, and Rebuttal Reports before the North Carolina Superior Court for Mecklenburg County in *Radiator Specialty Group v. Arrowood Indemnity Company, et al.*, 2015.

Deposition, Expert, and Rebuttal Reports before the United States District Court Western District of Pennsylvania in *The Goodyear Tire & Rubber Company v. Travelers Casualty and Surety Company and Travelers Indemnity Company*, 2015.

Expert and Rebuttal Reports before the United States District Court Eastern District of New York in *D. Joseph Kurtz, et al. vs. Kimberly-Clark Corporation and Costco Wholesale Corporation*, 2015.

Deposition and Expert Report before the United States District Court Northern District of California San Francisco Division in *Betty Dukes, et al. v. Wal-Mart Stores, Inc*., 2015.

Deposition and Expert Report before the United States District Court Southern District of Florida (Fort Lauderdale Division) in *Zenovida Love, et al. v Wal-Mart Stores, Inc.*, 2015.

Publications and Presentations (10 years)

"Trends in Wage and Hour Settlements: 2013 Update," (co-author) NERA Monograph, November 2013.

"Trends in Wage and Hour Settlements: 2012 Update," (co-author) NERA Monograph, March 2013.

 "Trends in Wage and Hour Settlements: 2011 Update," (co-author) NERA Monograph, March 2012.

"Recent Trends in Wage and Hour Settlements," (co-author) NERA Monograph, March 2011.

"Data in Wage and Hour Litigation: What to Do When You Have it and What to do When You Don't," (co-author) NERA Monograph, November 2010.

"Get in the Game: The Latest News and Developments in Wage and Hour Litigation," presented at the *4th Annual Section of Labor and Employment Law Conference,* Chicago, IL, November 2010.

"Why Daubert Makes Sense at Class Certification Under Title VII," (co-author) published in *Law 360*, July 2010.

"The Economic Impact of New MMSEA Regulations," (co-author) published in *Law360,* April 2010.

"The Economic Implications of Medicare Section 111 Reporting Requirements" presented at the *Asbestos Litigation Conference*, Beverly Hills, CA, February 2010.

"Class Certification in Wage and Hour Litigation: What Can We Learn from Statistics?" (co-author) NERA Monograph, November 2009.

"Wage and Hour: Advanced Topics in Litigation," presented at Law Seminars International conference on Litigating Employment Class Actions, April 2009.

"Implications of the Fair Pay Act for Statistical Analysis in Wage Discrimination Suits," (co-author) NERA Monograph, March 2009.

<div align="right">January 2019</div>

Exhibit B

Materials Considered

- Second Amended Complaint, Patricia Weeks, Alicia Helms, Brian McCloy, and Adrian Alcaraz, on behalf of themselves and all others similarly situated, Plaintiff, v. Google LLC, Defendant, United States District Court Northern District of California, San Jose Division, Case No. 5:18-cv-00801-NC, September 24, 2018.

- Plaintiff's Notice of Motion and Motion for Class Certification and Memorandum of Law in Support Thereof, Patricia Weeks, Alicia Helms, Brian McCloy, and Adrian Alcaraz, on behalf of themselves and all others similarly situated, Plaintiff, v. Google LLC, Defendant, United States District Court Northern District of California, San Jose Division, Case No. 5:18-cv-00801-NC, November 5, 2018.

- Google LLC's Responses to Plaintiffs' Priority Interrogatories, July 11, 2018.

- Deposition of Alicia Helms, November 20, 2018.

- Deposition of Adrian Alcaraz, December 10, 2018.

- Deposition of Brian McCloy, December 17, 2018.

- Deposition of Steven James and associated exhibits, August 30, 2018.

- Deposition of Stefan Boedeker, December 20, 2018.

- Expert Report of Dr. Samantha Iyengar, January 23, 2019.

- Expert Report of Stefan Boedeker, and associated materials, November 5, 2018.

    o Android Conjoint Draft Survey.docx

    o Android Pre-Survey Data

    o AndroidSurveyData102218.xlsx

    o Android Study.nb

    o BoxWhisker – Importance of Positive Attributes.png

    o Brands Purchased.png

    o Comparing Weighted Positive Attributes – Google - Others.xlsx

    o Financing.png

    o Google Model.png

- o Important of Attributes.png

- o Industry.png

- o Key Attributes.png

- o Materials Considered.pdf

- o Model Year.png

- o Purchasing Role.png

- o Respondents by Region.png

- o Smartphone Pre-Survey.docx

- o Survey Demographics.xlsx

- o Usage.png

- 18141988 CONFIDENTIAL - Pixel Returns re microphone issues.xlsx, produced without Bates numbers by Verizon on July 27, 2018.

- 18141988 CONFIDENTIAL Pixel Sales data.xlsx, produced without Bates numbers by Verizon on July 27, 2018.

- GOOG-WEEKS-00200111

- GOOG-WEEKS-00000114 - GOOG-WEEKS-00000119

- GOOG-WEEKS-00000609

- GOOG-WEEKS-00000610 - GOOG-WEEKS-00000621

- GOOG-WEEKS-00000622 - GOOG-WEEKS-00000638

- GOOG-WEEKS-00000639 - GOOG-WEEKS-00000659

- GOOG-WEEKS-00000660 - GOOG-WEEKS-00000686

- GOOG-WEEKS-00000687

- GOOG-WEEKS-00002663 - GOOG-WEEKS-00002671

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- GOOG-WEEKS-00005617 - GOOG-WEEKS-00005630

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- GOOG-WEEKS-00009807

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- GOOG-WEEKS-00039022 - GOOG-WEEKS-00039035

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- GOOG-WEEKS-00038889 - GOOG-WEEKS-00038904

- GOOG-WEEKS-00039825

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- GOOG-WEEKS-00039413 - GOOG-WEEKS-00039416

- GOOG-WEEKS-00039409 - GOOG-WEEKS-00039412

- GOOG-WEEKS-00039387 - GOOG-WEEKS-00039390

- GOOG-WEEKS-00039505 - GOOG-WEEKS-00039507

- GOOG-WEEKS-00039360 - GOOG-WEEKS-00039363

- GOOG-WEEKS-00039529

- GOOG-WEEKS-00039366 - GOOG-WEEKS-00039369

- GOOG-WEEKS-00039365

- GOOG-WEEKS-00039364

- GOOG-WEEKS-00039137 - GOOG-WEEKS-00039140

- GOOG-WEEKS-00039133 - GOOG-WEEKS-00039136

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- GOOG-WEEKS-00032460

- GOOG-WEEKS-00038868 - GOOG-WEEKS-00038871

- GOOG-WEEKS-00038909

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- GOOG-WEEKS-00038910

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- Verizon's website: www.verizonwireless.com, accessed January 11, 2019.

Exhibit C
35% of Consumers Did Not Pay a Price Within Mr. Boedeker's Assumed Range
Google Pixel Sales: Verizon Data
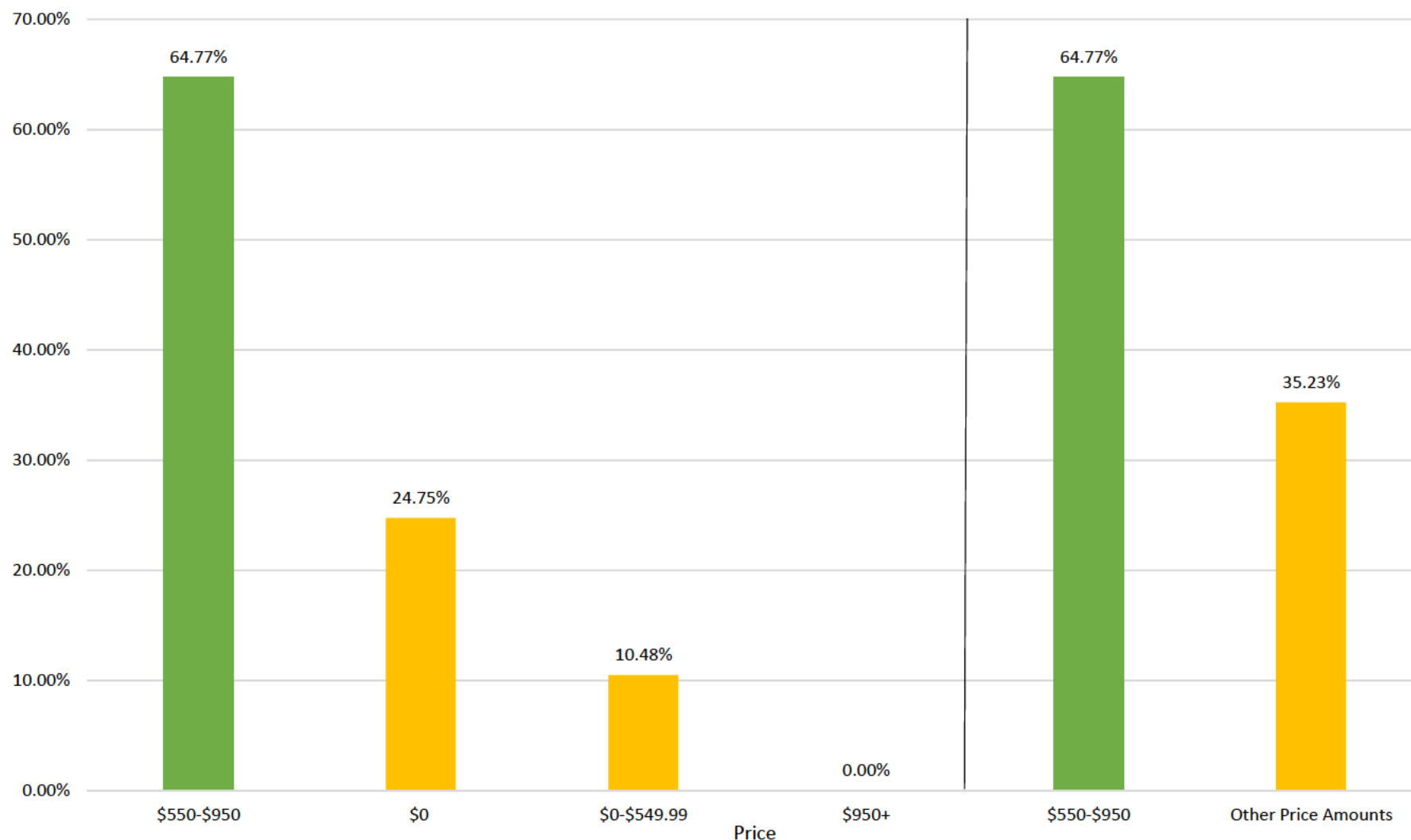
Notes and Sources:
- Price data are from file "18141988 CONFIDENTIAL Pixel Sales data.xlsx" produced without Bates numbers by Verizon on July 27, 2018. Price refers to value indicated in the [SOLD_PRICE_AMT] variable.
- Limited to sales without a business indicated in the [BUSINESS_NAME] variable.
- Includes sales with duplicative IMEI numbers. Additional analysis done to remove secondary and tertiary sales of the same first 14-digit IMEI number yielded similar results.

EXHIBIT 25

UNITED STATES DISTRICT COURT
NORTHERN DISTRICT OF CALIFORNIA
SAN JOSE DIVISION

PATRICIA WEEKS, ALICIA HELMS, BRIAN MCCLOY, and ADRIAN ALCARAZ, on behalf of themselves and all others similarly situated, Plaintiffs, v. GOOGLE LLC, Defendant.	Case No. 5:18-cv-00801-NC **EXPERT REPORT OF DR. SAMANTHA IYENGAR**

Table of Contents

I.   INTRODUCTION

1.   In connection with the above-captioned matter, I was asked by counsel for Google LLC ("Google") to review and evaluate the Expert Report of Stefan Boedeker, dated November 5, 2018 ("Boedeker Report"). In particular, I was asked to review and evaluate Mr. Boedeker's proposed design and use of a conjoint survey to "assess consumers' changes in choices and preferences if they were given the information at the point of purchase that the Pixel they are about to purchase has a manufacturing imperfection that could manifest after normal use of the smartphone"[1] and to opine on whether Mr. Boedeker's proposed conjoint survey would yield reliable results for the purpose of estimating the impact (if any) of the alleged defect on consumers' willingness to pay (or their subjective preferences) for the accused Pixel devices. The remainder of this report summarizes my analysis and opinions.

II.   QUALIFICATIONS

2.   I am a Senior Consultant at NERA Economic Consulting ("NERA"), specializing in survey research, design, and analysis. I have over 10 years of experience in the field of survey design and application, sample design and estimation, data management and statistical analysis in academic and litigation contexts. I have worked on a variety of survey and sampling projects for litigation and arbitration, including product liability, false advertising, consumers' willingness-to-pay, purchase and use behaviors, likelihood of confusion, and other issues involving consumer perceptions and behavior. I have submitted written reports relied upon in mediation and litigation matters and offered testimony at deposition.

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[1] Boedeker Report, ¶10.

3.   Prior to joining NERA, I was an academic in the fields of sociology and criminology. I was an Assistant Professor of Criminal Justice at the University of Michigan-Flint and Assistant Professor of Sociology at the University of Idaho, teaching courses including Methods of Social Research. In the academic context, I applied my survey research expertise on a number of projects, including institutional quality assessments and statistical analyses of large sample government survey data. I was awarded a Doctoral Dissertation Research Improvement Award from the National Science Foundation and was a fellow of the Bureau of Justice Statistics summer program on Quantitative Analysis of Crime and Criminal Justice Data. I hold B.A. and M.A. degrees in Sociology from the University of Montana and M.A. and Ph.D. degrees in Sociology from the University of Iowa.

4.   In particular, I have experience in designing, conducting and evaluating conjoint surveys used in commercial market research as well as in litigation, including product liability, false advertising, and patent matters. As part of my Ph.D., I completed graduate-level training in statistical techniques that are commonly used to analyze conjoint survey data. I have attended continuing education in advanced conjoint design and analysis developed and taught by leading researchers in the field of conjoint analysis from Sawtooth Software, as well as Bayesian statistical modeling offered by the American Association of Public Opinion Research (AAPOR). **Exhibit A** contains a current copy of my curriculum vitae.

5.   NERA is being compensated for my services in this matter at my standard rate of $445 per hour. Other NERA consultants assisted me in this engagement and are being compensated at rates less than $445 per hour. No part of NERA's compensation depends on the outcome of this litigation.

III.   DOCUMENTS RELIED UPON

6.   As part of my work, I reviewed the Second Amended Class Action Complaint ("Second Amended Complaint"), Plaintiffs' Notice of Motion and Motion for Class Certification, and

Memorandum of Law in Support Thereof ("Motion for Class Certification") and the Boedeker Report.

The list of the specific materials I relied upon in preparing this report is provided in **Exhibit B**.

IV.   ASSIGNMENT AND SUMMARY OF FINDINGS

7.   As noted above, I was asked to review Mr. Boedeker's proposed survey methodology and opine on the completeness and reliability of his proposed conjoint survey approach. In particular, I was asked to evaluate Mr. Boedeker's proposed conjoint survey methodology with regard to whether it would reliably measure the impact(s) of the alleged defect on consumers' subjective preferences or their willingness to pay for the Pixel devices at issue. My overall conclusion is that given the facts of the case, Mr. Boedeker's proposed conjoint survey methodology will not produce reliable results for use in estimating consumers' willingness to pay for the Pixel devices at issue with and without the "audio defect" as alleged by Plaintiffs. My opinions are discussed in more detail in this report, but my key conclusions can be summarized as follows:

- Mr. Boedeker fails to provide clear, unambiguous descriptions of key issues in this case, including the nature of the "audio defect," "propensity to fail" or "defect rate". Without clear instructions, respondents to Mr. Boedeker's proposed survey will likely make their own assumptions about any unspecified elements, and there is no guarantee that these assumptions would be in line with Plaintiffs' claims.

- The Boedeker Report provides no evidence that respondents will understand and be able to meaningfully distinguish between the various "failure rates" he proposes. Rather, literature suggests that it is likely that respondents will resort to simplification strategies – effectively interpreting his key attribute as "defective" or "not defective".

- Notably, Mr. Boedeker conducted a pre-test but failed to include a choice exercise or ask any question about how respondents would interpret his key attribute. Mr. Boedeker has not demonstrated that respondents to his proposed survey will understand and meaningfully interpret the key concepts as intended (i.e., in a way that is consistent with the harm alleged by Plaintiffs).

- It is likely that respondents to Mr. Boedeker's proposed conjoint survey will fail to understand key concepts in a manner that is consistent with Plaintiffs' case theory. As such, any dollar value estimated based on data from Mr. Boedeker's proposed survey will be meaningless for his intended purpose, as it will not accurately reflect consumers' willingness to pay for the Pixel devices at issue with and without the audio defect as alleged by Plaintiffs.

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- Mr. Boedeker's proposed survey methodology assumes that defects impacting the microphone (i.e., making/receiving calls), voice-activated assistant and speaker features are equally valued by consumers. To the extent that these things are not equally valued by consumers, Mr. Boedeker's proposed methodology has no way to separate them out.

- Adding to the difficulty of this exercise, the concept of an "audio defect" that occurs with a given "failure rate" is not part of the marketing materials for smartphones, nor would it necessarily be a feature that consumers would consider when purchasing a new device. Yet, Mr. Boedeker's proposed choice exercise presents these concepts in vague, poorly defined terms and then asks respondents to distinguish among highly technical and expensive items in an environment that fails to replicate the marketplace conditions for the Pixel devices at issue in real-life purchasing situations.

- Importantly, Mr. Boedeker's own analysis indicates that approximately 45 percent of respondents to his pre-test did not pay full price for their most recently purchased smartphone. Further analysis of Mr. Boedeker's pre-test data reveals that the majority of Android purchasers received a discount and/or financed/leased their device through a long-term commitment. Despite this, Mr. Boedeker's proposed survey design asks respondents to *assume* that they would pay full price in a single payment and fails to include options that would realistically replicate the marketplace experience of these consumers.

- To the extent that the alternatives in Mr. Boedeker's proposed study do not approximate the actual prices paid by consumers and/or other key elements of real-life purchasing situations for the devices at issue, it is unlikely that his proposed survey methodology will reflect the choices that consumers in the relevant population would make in the marketplace.

- Finally, despite a lengthy discussion of general issues relating to conjoint studies and online survey methodology, Mr. Boedeker's proposal is vague and does not contain sufficient information to demonstrate that his proposed conjoint survey methodology would be reliable for his stated purpose.

V.   BACKGROUND

8.   I understand that Plaintiffs claim that Google's Pixel and Pixel XL phones are defective, such that the microphones on these devices are prone to failure.[2] Specifically, Plaintiffs note that "people who experienced the defect could not be heard when talking on the phone and lost the ability to use the voice-assistant feature that Google marketed."[3] Moreover, I understand that

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[2] Second Amended Complaint, ¶1.

[3] Motion for Class Certification, 1: 27 – 2: 1.

Plaintiffs allege that Google "deliberately concealed that the Pixel was failure-prone,"[4] knowingly sold Pixel devices without disclosing the alleged defect,[5] and failed to provide refunds or non-defective replacements.[6]   Plaintiffs further claim, "[i]f Google had notified Plaintiffs of the microphone problems, they would not have purchased a Class Phone or would have returned it during the two-week buyer's remorse period, or at the very least they would not have paid what they did for the faulty device."[7]

9.   I understand that Plaintiffs seek to represent a class defined as,

All individuals in the United States who purchased, from Google or an authorized retailer, other than for resale, a Google Pixel or Pixel XL smartphone that was manufactured before January 5, 2017 ("Class Phones"). Excluded from the class are Google, its officers, directors, employees, subsidiaries, and affiliates; all judges assigned to this case and any members of their immediate families; the parties' counsel in this litigation; and any individuals who received a full cash refund or a non-Class Phone as a replacement for the purchased Class Phone.[8]

Plaintiffs alternatively request certification of a class limited to all individuals in the United States who purchased a Class Phone, other than for resale, directly from Google anywhere in the United States or an authorized retailer in California.[9]

10.   I understand Plaintiffs retained Mr. Boedeker as a damages expert.[10] Plaintiffs indicate that Mr. Boedeker intends to conduct a conjoint survey for the purpose of "test[ing] the impact of the defect on consumer demand for the Pixel."[11]   Plaintiffs further note that Mr. Boedeker intends to "quantify the amount or percentage by which each class member overpaid as a result of purchasing a

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[4] Motion for Class Certification, 1: 24-26.

[5] Motion for Class Certification, 2: 21-23.

[6] Motion for Class Certification, 11: 8-10.

[7] Internal citations omitted. Motion for Class Certification, 11: 17-20.

[8] Motion for Class Certification, 12:4-9.

[9] Motion for Class Certification, footnote 8.

[10] Motion for Class Certification, 23: 22-26.

[11] Motion for Class Certification, 23: 22-26.

Pixel with a concealed defect"[12] as well as "measure the degree to which consumers would pay less for a smartphone if the manufacturer were to disclose at the time of sale that the audio features have a propensity to fail."[13]

11.   I understand that Mr. Boedeker submitted an expert report on November 5, 2018. I further understand that Mr. Boedeker produced additional materials on December 19, 2018, including a draft questionnaire for his proposed conjoint study (Android Conjoint Draft Survey). I have been asked as a survey expert to review Mr. Boedeker's proposed survey methodology and opine on its completeness and reliability. In particular, I was asked to review and evaluate Mr. Boedeker's proposed design and use of a conjoint survey to "assess consumers' changes in choices and preferences if they were given the information at the point of purchase that the Pixel they are about to purchase has a manufacturing imperfection that could manifest after normal use of the smartphone"[14] and to opine on whether the proposed survey methodology will yield reliable results for the purpose of estimating the impact (if any) of the alleged defect on consumers' willingness to pay (or their subjective preferences) for the accused Pixel devices.[15]

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[12] Motion for Class Certification, 24: 16-18.

[13] Motion for Class Certification, 24: 20-22.

[14] Boedeker Report, ¶10.

[15] Based on the literature on conjoint analysis, it is my understanding that Mr. Boedeker's proposed conjoint study cannot be used in isolation to estimate the "price premium" (if any) that consumers paid for the Pixel devices due to the alleged undisclosed "audio defect". While conjoint analysis can be used to estimate consumers' subjective preferences (or willingness to pay) for particular product features, this is not the same as what a firm could charge for a product with and without the feature in a functioning market. This is because prices of products in the real world are not determined solely by consumers' preferences but are also influenced by other factors. As leading researchers in the field of conjoint analysis explain, "[w]hile conjoint estimates enable the damages expert to forecast demand for a non-misrepresented version of the accused product, additional analysis is required to determine P_{new}, the market price for this version of the accused product. **In particular, the conjoint-based demand forecast must be incorporated into an economic analysis that also takes into account factors such as costs and competition among suppliers. In such an analysis, the accused seller will typically drop the price of the non-misrepresented version of its product in order to compete more successfully with rival firms. However, the amount of this price drop generally cannot be determined by consumers' valuation of the accused feature alone** (i.e., an amount represented by the vertical distance between A and C in Figure 1). If the analysis employed does not also account for costs and other market forces such as competition among suppliers, the resulting damages estimates may be significantly overstated." Emphasis added. Allenby, G., Rossi, P., Cameron, L., and Li, Y. 2017. "Computing

A. AN OVERVIEW OF MR. BOEDEKER'S PROPOSED CONJOINT SURVEY METHODOLOGY

12.   Mr. Boedeker proposes to conduct a choice based conjoint (CBC) survey to "quantify the value that consumers assign to attributes of smartphones, including a properly functioning microphone."[16] Mr. Boedeker conducted a pre-test study "to gain an understanding of how certain attributes impact preferences and choice behaviors of consumers and how consumers rank the importance of such attributes"[17] Mr. Boedeker defined the relevant population for his pre-test study as US adults 18 years or older who are "recent purchasers of Android smartphones, including Google phones."[18] Selected findings from this pre-test study are presented in the Boedeker Report.[19] Mr. Boedeker concludes, "[b]ased on the results of the Pre-Test Survey, I selected the following attributes for the Conjoint Survey in addition to Price and the description of the defect: a. Battery life, ranked second; b. Screen size, ranked sixth; c. Camera resolution, ranked seventh; d. Memory capacity ranked eighth."[20]

13.   The description of the proposed CBC design presented in the Boedeker Report instructs respondents to assume the following scenario:

> *Next, we will ask you a series of questions about your preferences for smartphones. For this exercise, please assume that you are planning to buy a smartphone. You have already settled*

Damages in Product Liability Mislabeling Cases: Plaintiffs' Mistaken Approach in *Briseno v. Conagra*." *Product Safety & Liability Reporter*, 45 PSLR 208.

[16] Boedeker Report, ¶88.

[17] Boedeker Report, ¶95.

[18] Boedeker Report, ¶¶96, 97.

[19] Boedeker Report, ¶¶99-109. Table 2 of the Boedeker Report presents the results of statistical tests for differences between Pixel purchasers and all others in Mr. Boedeker's pre-test. Based on these results, he concludes that there are no significant differences regarding the importance of various attributes (with the exception of price). The test results presented for "[o]wners of Google phones" appear to be based on a sub-sample of 29 respondents to Mr. Boedeker's pre-test who indicated that they had purchased any Pixel phone (i.e., including Pixel 2 and Pixel 2 XL). However, it is worth noting that only 9 respondents in Mr. Boedeker's pre-test indicated that they had purchased one of the devices at issue (i.e., Pixel or Pixel XL). See Boedeker Report, Figure 10.

[20] Boedeker Report, ¶109.

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on the design and brand and have chosen a model for $700. You intend to buy this phone at the retail price. The model for $700 has the following features:

    a. Battery life measured in talk time of 26h,

    b. A screen size of 5.66 X 2.74 inches,

    c. A back camera resolution of 12.3 megapixels with built in gyroscope for image stabilization, and

    d. A storage capacity of 64 GB. [21]

On the following screens you are offered an incremental package at an incremental price.

The incremental options you can choose from are as follows:

    a. Talk time of 20h, 26h, 30h;

    b. Screen size of 5-inch (130 mm) AMOLED display panel with 1920×1080 resolution/6-inch (150 mm) P-OLED display panel with 2880×1440 resolution;

    c. 12.2 megapixel rear camera capable of recording 4K video at 30 FPS/18 megapixel rear camera capable of recording 4K video at 60 FPS

    d. Storage options of 64/128 GB. [22]

14.   Regarding the alleged defect, the Boedeker Report proposes to instruct respondents:

*In addition to these additional option packages, the sales person also discloses to you that there are **inherent problems with the phone's audio** that can occur during regular use of the smartphone: Accordingly, when **the audio defect manifests with a certain probability**, the user cannot make or receive phone calls without headphones, use the speakers, or use the voice-activated assistant feature.* [23]

15.   In addition, Mr. Boedeker proposes to instruct respondents,

You will be presented with 12 choice menus that contain information about the incremental attributes of the smartphone and a dollar amount that represents that represents [sic] the price you are willing to pay for the smartphone described in that option depending on how you value the additional choices for each attribute. Please select the combination of attributes and price that is most attractive to you. Once you select your most attractive option, you will be asked to confirm that you would purchase [that] option. If none of the presented options appears attractive to you, you can select "None – I would not buy any of these."

There are no correct or incorrect answers in this exercise. We are just interested in your opinion. [24]

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[21] Italics in original. Boedeker Report, ¶111.

[22] Italics in original. Boedeker Report, ¶111.

[23] Italics in original, bold emphasis added. Boedeker Report, ¶111.

[24] Italics in original. Boedeker Report, ¶111.

16.   The Boedeker Report provides an "illustrative example of a conjoint choice menu" [25] or CBC choice set, shown below. Mr. Boedeker notes, "[e]ach participant will go through several such screens. Each screen shows randomly selected levels for each attribute. Therefore, Figure 16 does not necessarily show all levels for each attribute."[26]

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[25] Boedeker Report, Figure 16.

[26] Boedeker Report, ¶112.

Figure 16: Example of a CBC Choice Menu

	Option 1	Option 2	Option 3	Option 4	Option 5
Talk time	Yes	No	Yes	No	No
Screen size	*5-inch (130 mm) AMOLED display panel with 1920×1080 resolution*	*6-inch (150 mm) P-OLED display panel with 2880×1440 resolution*	*5-inch (130 mm) AMOLED display panel with 1920×1080 resolution*	*6-inch (150 mm) P-OLED display panel with 2880×1440 resolution*	*No5-inch (130 mm) AMOLED display panel with 1920×1080 resolution*
Camera	*18 megapixel rear camera capable of recording 4K video at 60 FPS*	*12.2 megapixel rear camera capable of recording 4K video at 30 FPS*	*18 megapixel rear camera capable of recording 4K video at 60 FPS*	*12.2 megapixel rear camera capable of recording 4K video at 30 FPS*	*18 megapixel rear camera capable of recording 4K video at 60 FPS*
Memory capacity	64	128	128	64	64
User cannot make or receive phone calls without headphones, use the speakers, or use the voice-activated assistant feature	6.8 in 100 chance of at least one of these defects	4.4 in 100 chance of at least one of these defects	No defect	9.2 in 100 chance of at least one of these defects	No defect
Price	$550	$950	$750	$650	$850
Which option would you prefer?	☐	☐	☐	☐	☐

Source: Illustrative Example.

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17.   As shown in the left most column of the example above, the survey methodology proposed in the Boedeker Report would include six attributes in the conjoint study, including talk time, screen, size, camera, memory capacity and price. To represent the alleged defect, the Boedeker Report includes an attribute titled "*[u]ser cannot make or receive phone calls without headphones, use the speakers, or use the voice-activated assistance feature*"[27] ("defect attribute"). Mr. Boedeker apparently intends to offer at least four levels or options for this attribute (i.e., "no defect", "4.4 in 100 chance of at least one of these defects", "6.8 in 100 chance of at least one of these defects" or "9.2 in 100 chance of at least one of these defects").

18.   As noted above, I understand that following the submission of his report, Mr. Boedeker produced a draft questionnaire for his proposed conjoint study (Android Conjoint Draft Survey). The screening questions provided in the Android Conjoint Draft Survey suggest that the population for Mr. Boedeker's proposed CBC study would be defined as US adults 18 years and older who purchased (and were involved in the decision to purchase) an Apple, Google, Samsung, HTC, Huawei or LG smartphone between the years of 2015-2018 for personal use.[28]

19.   The CBC design proposed in the Android Conjoint Draft Survey instructs respondents to assume the following scenario:

> Next, we will ask you a series of questions about your preferences for smartphones. For this exercise, please assume that you are planning to buy an Android smartphone. You have already settled on the design and brand and you have chosen a model priced at $700. You intend to buy this phone at the full retail price. The model for $700 has the following features:
> a)   Android operating system
> b)   Battery life measured in talk time of 26 hours
> c)   A screen size of 5.66 x 2.74 inches
> d)   A camera resolution of 12.3 megapixels with built in gyroscope for image stabilization,
> e)   A storage capacity of 64 GB,
> f)   A digital assistant, and
> g)   Unlimited cloud storage for photos and videos

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[27] Italics in original. Boedeker Report, Figure 16.

[28] Android Conjoint Draft Survey, pp. 1-6.

On the following screens you are offered different option packages at different prices.
The options you can choose from are as follows:

a) Talk time of 20h, 26h, 30h;
b) Screen size of 5-inch (130 mm) AMOLED display panel with 1920×1080 resolution/6-inch (150 mm) P-OLED display panel with 2880×1440 resolution;
c) 12.2-megapixel rear camera capable of recording 4K video at 30 FPS/18 megapixel rear camera capable of recording 4K video at 60 FPS;
d) Storage options of 64/128 GB. [29]

20.   Regarding the alleged defect, the Android Conjoint Draft Survey includes the following

instructions to respondents:

In addition to these additional option packages, the salesperson also discloses to you that—for some of the phones—there are **inherent problems with the phone's audio** that can occur during regular use of the phone. For purposes of this survey, the audio problems are called the "audio defect". When the audio defect occurs, the phone's microphones and audio malfunction, and the user cannot reliably make or receive phone calls without using headphones, a Bluetooth device, or speakerphone. The audio defect also prevents the user from using voice commands to activate the phone's digital assistant without headphones or a Bluetooth device. Sometimes users also experience speaker failure. The audio defect does not occur in all phones, but does manifest in a portion of the phones.[30]

21.   Later in the Android Conjoint Draft Survey, Mr. Boedeker provides another proposed

description of the "audio defect" with a corresponding set of levels described as a "Failure Rate".[31]

Audio Defect	**The Audio Defect.** The phone suffers from a defect that causes the phone's microphones and audio to malfunction, preventing the user from reliably making or receiving phone calls, or using the phone's voice activated digital assistant, without using headphones, a Bluetooth device, or speakerphone. The audio defect also can also result in speaker failure.
	Failure Rate. The audio defect defined above will occur with the following likelihood:
	(1) No failures;
	(2) 1--3%;
	(3) 3--6%; or
	(4) 6--9%.

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[29] Android Conjoint Draft Survey, p. 7.

[30] Emphasis added. Android Conjoint Draft Survey, p. 7.

[31] Android Conjoint Draft Survey, p. 10.

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22.   The Android Conjoint Draft Survey also includes an example choice exercise, as shown below.[32]

	Option					
	1	2	3	4	5	6
Battery life measured as talk time	20h	26h	30h	30h	20h	None
Camera	12.2 megapixel rear camera capable of recording 4K video at 30 FPS	18 megapixel rear camera capable of recording 4K video at 60 FPS	18 megapixel rear camera capable of recording 4K video at 60 FPS	12.2 megapixel rear camera capable of recording 4K video at 30 FPS	12.2 megapixel rear camera capable of recording 4K video at 30 FPS	Of
Screen size	5-inch (130 mm) AMOLED display panel with 1920×1080 resolution	6-inch (150 mm) P-OLED display panel with 2880×1440 resolution	5-inch (130 mm) AMOLED display panel with 1920×1080 resolution	5-inch (130 mm) AMOLED display panel with 1920×1080 resolution	6-inch (150 mm) P-OLED display panel with 2880×1440 resolution	the
Memory capacity	64GB	128GB	64GB	128GB	64GB	Above
Audio Defect	No defect	1 to 3 in 100 chance of having audio defect	3 to 6 in 100 chance of having audio defect	6 to 9 in 100 chance of having audio defect	3 to 6 in 100 chance of having audio defect	
Price	$850	$650	$700	$550	$950	
Which option would you prefer?	O	O	O	O	O	O

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[32] Android Conjoint Draft Survey, p. 12.

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VI.   KEY POINTS IN RESPONSE TO MR. BOEDEKER'S PROPOSED SURVEY METHODOLOGY

A.   MR. BOEDEKER'S PROPOSED DESCRIPTION OF THE "DEFECT" IS VAGUE, POORLY DEFINED AND UNLIKELY TO BE UNDERSTOOD IN A MANNER CONSISTENT WITH PLAINTIFFS' CLAIMS

23.   Choice-based conjoint (CBC) studies of the type proposed by Mr. Boedeker generally refer to a methodology in which respondents are asked to choose among hypothetical product configurations. Product configurations are defined in terms of attributes or features. Attributes are product characteristics (such as brand and price), which are defined in terms of various levels of specificity (e.g., levels of a brand attribute in a conjoint survey on smartphones might include Apple, Google, LG and Samsung).

24.   Properly defining attributes and specific levels with particularity is crucial for the reliability of any CBC study. As Bryan Orme (whose work is cited in the Boedeker Report[33]) notes,

> Defining proper attributes and levels is arguably the most fundamental and critical aspect of designing a good conjoint study. It is also often the most time-consuming step in executing a conjoint analysis project. An attribute (sometimes called a factor) is a characteristic of a product (e.g., color), made up of various levels (there must be at least two for each attribute) or degrees of that characteristic (e.g., red, yellow, blue). The underlying theory of conjoint analysis holds that buyers view products as composed of various attributes and levels. Buyers place a certain part-worth utility on each of those characteristics, and we can determine the overall utility of any product by summing the value of its parts or levels.[34]

25.   Given Plaintiffs' claims, it is of utmost importance to clearly define both the nature of the alleged "audio defect" as well as the "propensity to fail" or "failure rate" in a way that respondents will understand and is consistent with Plaintiffs' theory of the case. As the Reference Guide on Survey Research explains,

> Although it seems obvious that questions on a survey should be clear and precise, phrasing questions to reach that goal is often difficult. Even questions that appear clear can convey unexpected meanings and ambiguities to potential respondents. For example, the question "What is the average number of days each week you have butter?" appears to be straightforward. Yet some respondents wondered

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[33] Boedeker Report, ¶47.

[34] See p. 53 in Orme, B. 2014. *Getting Started with Conjoint Analysis, 3rd Edition.* Manhattan Beach, CA: Research Publishers LLC ("Orme 2014").

whether margarine counted as butter, and when the question was revised to include the introductory phrase "not including margarine," the reported frequency of butter use dropped dramatically.

When unclear questions are included in a survey, they may threaten the validity of the survey by systematically distorting responses if respondents are misled in a particular direction, or by inflating random error if respondents guess because they do not understand the question. **If the crucial question is sufficiently ambiguous or unclear, it may be the basis for rejecting the survey**.[35]

26.   Likewise, Orme notes,

Attribute descriptions should be concise statements with concrete meaning. Avoid using ranges to describe a single level of an attribute, such as "weighs 3 to 5 kilos." Rather than leaving the interpretation to the respondent, it would be better to specify "weighs 4 kilos." Levels such as "superior performance" also leave too much in question. What does "superior performance" mean? Try to use specific language to quantify (if possible) the exact meaning of the level.[36]

This is of particular importance here, as Mr. Boedeker intends to use the results of his proposed conjoint survey for the purpose of "measure[ing] the degree to which consumers would pay less for a smartphone if the manufacturer were to disclose at the time of sale that the audio features have a propensity to fail."[37] Without defining these key concepts, there is no guarantee that respondents would understand the attributes in Mr. Boedeker's proposed CBC study in a way that is consistent with Plaintiffs' claims, and thus, no reason to believe that the results of the study (e.g., the subjective value respondents assign to a product with versus without the "audio defect" attribute) would necessarily be tied to Plaintiffs' theory of liability. Put differently, if respondents fail to understand key concepts in a manner that is consistent with Plaintiffs' case theory, any estimate of consumers' subjective valuation (e.g., quantified as a dollar value, as a willingness to pay) that is generated from Mr. Boedeker's conjoint survey results will be meaningless for its intended purpose, as it will not accurately reflect consumers' subjective preferences for the Pixel devices at issue with and without the audio defect as alleged by Plaintiffs.

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[35] Internal citations omitted, and emphasis added. Diamond, Shari S. 2011. "Reference Guide on Survey Research," in Reference Manual on Scientific Evidence, Third Edition, Federal Judicial Center ("Diamond 2011"), pp. 387–388.

[36] Orme 2014, p. 54.

[37] Motion for Class Certification, 24: 20-22.

27.   This is of particular concern here, as Plaintiffs' claims involve complex concepts that are potentially difficult for respondents to understand, including the alleged "audio defect" as well as the "propensity to fail" or "failure rate." Yet, as described in the Boedeker Report and the Android Conjoint Draft Survey, these concepts are vague and poorly defined. As noted earlier, Mr. Boedeker proposes to include the phrase "***inherent problems** with the phone's audio*"[38] in his descriptions of the alleged defect.   It is likely that at least some respondents would interpret this statement as indicating that the alleged defect is *certain* to occur. Moreover, the context in which the statement appears may also lead to confusion, as Mr. Boedeker's proposed descriptions include statements such as "*the audio defect manifests with a **certain probability***"[39] or note that the audio defect *"does not occur in all phones, but does manifest in a portion of the phones."* It is unclear how respondents would reconcile potentially conflicting statements.

28.   The Boedeker Report does not provide a complete list of the levels that would define his "defect" attribute, as noted earlier, but apparently would include least four, specifically: (1) "no defect"; (2) "4.4 in 100 chance of at least one of these defects"; (3) "6.8 in 100 chance of at least one of these defects"; and (4) "9.2 in 100 chance of at least one of these defects".[40]   Here again, the Boedeker Report provides very little instruction to respondents about how they should interpret the various options presented and it is unclear what assumptions they would make. For example, would respondents interpret Mr. Boedeker's proposed options as indicating that the defect is certain to occur in X phones out of 100? Or that X times out of 100 times using the phone it fails to perform one or more of the listed audio functions? Likewise, it is unclear how respondents would interpret what "[X]

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[38]   Italics in original. Bold emphasis added. Boedeker Report, ¶111; see also Android Conjoint Draft Survey, p. 7.

[39]   Italics in original. Bold emphasis added. Boedeker Report, ¶111.

[40]   Android Conjoint Draft Survey, p. 12.

in 100" would mean for them on a practical level. For example, it is unclear how respondents would interpret "*4.4 in 100*"[41] in terms of devices. What would it mean in concrete terms for respondents that approximately four and a half phones in 100 could be defective, and would they understand that to be meaningfully different from six and eight tenths phones in 100?

29.   The wording proposed for the "Audio Defect" as described in the Android Conjoint Draft Survey is similarly vague, poorly defined and would likely be subject to the same problems with regard to respondents' interpretations.[42]   Moreover, the levels proposed for this "Audio Defect" attribute present additional problems, as they are not mutually exclusive.   Specifically, the "Audio Defect" (as described in the Android Conjoint Draft Survey) is said to occur with a "likelihood" of either (1) "No failures"; (2) 1-3 percent or 1 to 3 in 100 chance of having audio defect; (3) 3-6 percent or 3 to 6 in 100 chance of having audio defect; or (4) 6-9 percent or 6 to 9 in 100 chance of having audio defect.[43] It is unclear how respondents would interpret these options. For example, how would a respondent be able to meaningfully distinguish between "3 to 6 in 100" versus "6 to 9 in 100"? As it is written, "6 in 100" could occur in either case. This goes against guidance from Orme, who notes,

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[41] Boedeker Report, Fig. 16.

[42] Although the Android Conjoint Draft Survey (p. 14) includes two questions that are apparently intended to gauge respondents' understanding of the proposed survey questions, this is not sufficient for the purposes of demonstrating that respondents understood the choice exercise and key concepts as intended. For example, Mr. Boedeker proposes to ask respondents, "[d]id you have a clear understanding of the questions in this survey?" Respondents who answer in the affirmative would be given the opportunity to input a response to the next question, "[w]hich part did you not clearly understand?" (Android Conjoint Draft Survey, p. 14.)   This procedure is unlikely to produce meaningful results with regard to whether respondents understood the key attributes in the choice exercise in a manner that is consistent with Plaintiffs' claims versus alternative interpretations. Survey literature has long held that respondents seek to be viewed favorably (Weisberg, H. 2005. *The Total Survey Error Approach: A Guide to the New Science of Survey Research.* Chicago: University of Chicago Press, p. 85). In this context, respondents often hesitate to admit when they have failed to understand something. Moreover, respondents who made assumptions that are inconsistent with Plaintiffs' claims (and thus failed to understand the concepts of "audio defect" and "failure rate" in the specific way that Mr. Boedeker intended) would not necessarily be aware of this.

[43] Android Conjoint Draft Survey, pp. 10 and 12.

"[l]evels within each attribute should be mutually exclusive."[44]   Despite this guidance, the attribute levels proposed in the Android Conjoint Draft Survey contain overlapping information.

30.   Moreover, it is unclear whether the levels of the "Audio Defect" attribute (as proposed in the Android Conjoint Draft Survey) tie to Plaintiffs' claimed "failure rate" of 6.8 percent. Likewise, it is unclear how the resulting data on consumers' subjective preferences for "no defect" or "1 to 3 in 100 chance of having audio defect" or "3 to 6 in 100 chance of having audio defect" or "6 to 9 in 100 chance of having audio defect" would be used (as Mr. Boedeker suggests) to calculate the subjective value consumers assign to a product with a particular manifestation rate of the alleged defect.[45]

31.   Regarding the nature of the alleged defect, the Boedeker Report states*, "the user **cannot** make or receive phone calls without headphones, use the speakers, or use the voice-activated assistant feature."*[46]   Here again, it is unclear whether respondents' interpretation(s) would be consistent with Plaintiffs' claims. For example, some respondents may assume the statement implies that when the audio defect manifests, it leads to complete inoperability with regard to the three features listed in Mr. Boedeker's description. Other respondents may assume that the device would become inoperable with regard only one feature, or for two out of three of the listed features.

32.   Similarly, the proposed levels of the defect attribute (as described in the Boedeker Report) encompass multiple possibilities regarding the specific ways that the phone could become inoperable due to the manifestation of an audio defect. For example, "[*X*] *in 100 chance of at least one of these defects*" encompasses scenarios in which one, two or all three of the specific features listed could be impacted. Likewise, the description proposed for the "Audio Defect" attribute

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[44] Orme 2014, p. 55.

[45] Boedeker Report, ¶133.

[46] Italics in original. Bold emphasis added. Boedeker Report, ¶111.

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presented in the Android Conjoint Draft Survey combines a number of features that could potentially become inoperable if the "audio defect" should manifest.[47] Here again, Mr. Boedeker provides very little instruction to respondents regarding how they should interpret the various options presented and we do not know what assumptions they would make. Some respondents may assume that all identified features would become inoperable, while others may assume that some, but not all, of the listed features would be impacted.

33.   The net effect is that both of Mr. Boedeker's proposed survey designs effectively assume that respondents would assign equivalent value to each potentially impacted feature. Put differently, Mr. Boedeker's proposed survey methodology assumes that functionalities relating to the microphone (i.e., making/receiving calls), voice-activated assistant and speaker features are equally valued by consumers. To the extent that respondents make different assumptions about the specific feature(s) that would become fully or partially inoperable and/or assign different value to the complete or partial loss of one type of functionality versus the other(s), Mr. Boedeker's proposed methodology has no way to separate them out.

34.   In sum, Mr. Boedeker fails to present Plaintiffs' claims regarding the "audio defect" "propensity for failure" or "defect rate" in a way that would be clearly and unambiguously interpreted by respondents. As written, it is unclear what interpretations each respondent would make about the "audio defect" attribute and its implications for the products in the choice sets, including what is meant by the "failure rate" that could occur with any given "likelihood" or the specific ways in which the functionality of a device could be impaired. As such, Mr. Boedeker's proposed survey methodology will not reliably measure the subjective value consumers assign (e.g., their willingness to pay) (if any) that is tied to Plaintiffs' theory of liability, as we do not know what assumption(s) respondents would

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[47] Android Conjoint Draft Survey, p. 7.

make about the "audio defect" or the corresponding "failure rates" associated with the products they would be asked to choose among, or whether those assumptions are at all consistent with Plaintiffs' claims.

B. IT IS LIKELY THAT RESPONDENTS WILL INTERPRET MR. BOEDEKER'S PROPOSED "AUDIO DEFECT" ATTRIBUTE AS "DEFECTIVE" OR "NOT DEFECTIVE"

35.   Adding to the complexity of Mr. Boedeker's proposed study, the concept of an "audio defect" that occurs with a given likelihood or "failure rate" is not a feature that is generally described to consumers as part of the marketing materials for smartphones, and thus would not necessarily be among the attributes consumers would generally consider when assessing their options for a new smartphone. As such, it should not be assumed that consumers would necessarily understand the concepts of the "audio defect" or "failure rate" in the way that Mr. Boedeker intends, nor should it be assumed that consumers would necessarily have an understanding of how much a smartphone with a given likelihood of manifesting an "audio defect" should cost.

36.   When consumers lack certainty when evaluating a given product or feature, conjoint or other forms of hypothetical choice studies can generate flawed results, with values that are potentially skewed very high or low.[48] In these situations, survey respondents may rely heavily on the wording of the questions for cues about how to interpret the attribute and what it should be worth.[49] Here, Mr. Boedeker proposes a scenario in which respondents are asked to evaluate products based on a feature

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[48] As Ready and colleagues explain, "[i]n a choice experiment study, willingness to pay for a public [*i.e.,* nonmarket] good estimated from hypothetical choices was three times as large as willingness to pay estimated from choices requiring actual payment. This hypothetical bias was related to the stated level of certainty of respondents." *See* p. 363 in Ready, R., Champ, P., and Lawton, J. 2010. "Using Respondent Uncertainty to Mitigate Hypothetical Bias in a Stated Choice Experiment" *Land Economics*, 86(2):363-381.

[49] As Loomis explains, "… respondents gain utility from giving answers that are consistent with social norms rather than their own personal values. Specifically, the respondent gains utility from pleasing the interviewer or maintaining a positive self-image. However, when they are faced with an actual cash situation, respondents behave more selfishly." *See* p. 38 in Loomis, J. 2014. "2013 WAEA Keynote Address: Strategies for Overcoming Hypothetical Bias in Stated Preference Surveys" *Journal of Agricultural and Resource Economics,* 39(1):34–46.

that is described in vague and ambiguous terms, is highly technical and complex, and within a set of options in which one is clearly preferable compared to all others (i.e., "no defect" or "no failures").

37.   Furthermore, experts in the field of conjoint analysis have long recognized the potential for respondents to engage in simplification strategies when faced with complex decisions, especially in situations where they are being asked to evaluate four or more product offerings for complex, expensive and/or infrequently purchased (i.e., "high-involvement"[50]) items.   To elaborate, the literature on conjoint analysis suggests that, in such a scenario, respondents will frequently resort to applying "must-have" or "must-avoid" rules. For example, in this case, that could mean employing cognitive shortcuts to simplify Mr. Boedeker's proposed "audio defect" and "failure rate" options to "defective" or "not defective".

38.   As Orme explains, conjoint studies assume a theory of additivity, whereby respondents use an additive compensatory rule when making product selections. Following this theoretical framework, less desirable features are assumed to be overcome by the presence of more desirable features (in other words, desirable characteristics can make up for undesirable characteristics).[51]

39.   However, researchers have identified situations in which respondents may not behave in a manner that is consistent with the theory of additivity, and instead resort to cognitive shortcuts to simplify the exercise. For example, Orme and Chrzan note,

> Respondents often don't use the additive compensatory rule when answering CBC [choice based conjoint] tasks regarding high involvement categories– especially when they involve four or more concepts. You frequently can observe respondents applying must-have or must-avoid rules on attribute levels to screen the concepts to the very few concepts (often two) within the task that they trade off more carefully prior to making their final choice.[52]

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[50] Kolter, R. and Armstrong, G. 2012. *Principles of Marketing, 14th Edition*. Upper Saddle River, NJ: Prentice Hall, p. 150.

[51] Orme 2014, pp. 160-161.

[52] Internal citations omitted. Orme, B. and Chrzan, K. 2017. *Becoming an Expert in Conjoint Analysis: Choice Modeling for Pros*. Orem, UT: Sawtooth Software ("Orme and Chrzan 2017"), p. 53.

40.   Here, Mr. Boedeker proposes to present respondents with choice menus including "five choices with various combinations of product attributes and prices"[53] of smartphone packages, which would likely fall into the "high-involvement" category for many respondents. Thus, despite Mr. Boedeker's claim that his proposed survey methodology "contains an attribute manifesting the likelihood of manifestation which allows for the quantification of economic losses as a function of the manifestation rate",[54] it is likely that many respondents may be unwilling or unable to make meaningful selections among the various failure rates he proposes, and may instead resort to cognitive shortcuts in which they define must-have (i.e., "no defect" or "no failures") and must-avoid characteristics (i.e., any option other than "no defect" or "no failures"). Put differently, it is likely that respondents to Mr. Boedeker's proposed study will, in practice, resort to cognitive shortcuts whereby they effectively interpret his key attribute as indicating that the product is either "defective" or "not defective" and thus avoid the cognitive difficulty of making meaningful selections among complex products shown to have failure rates other than "no defect" or "no failures."

41.   When designing conjoint surveys for litigation, especially those involving complex and/or technical concepts, it is not uncommon to pretest the survey instrument to gain insight into how respondents interpret or understand the attributes and other information presented.[55] Significantly, Mr. Boedeker intends to use the results of his conjoint survey to "measure the degree to which consumers would pay less for a smartphone if the manufacturer were to disclose at the time of sale that the audio features have a propensity to fail,"[56] yet it appears he has not completed much of the

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[53] Boedeker Report, ¶112.

[54] Boedeker Report, ¶133.

[55] Allenby, G., Brazell, J., Howell, J., and Rossi, P. 2014. "Valuation of Patented Product Features." *Journal of Law and Economics*, 57(3): p. 643.

[56] Motion for Class Certification, 24: 20-22.

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work that is necessary to ensure that the results of his CBC study could be reliably used for this purpose, including pre-testing the survey instrument to ensure that the product offerings presented in the proposed choice exercise are being understood and interpreted by respondents in the manner consistent with Plaintiffs' case theory.

42.   Critically, Mr. Boedeker failed to ask any question in his pre-test regarding how respondents would understand his "audio defect" attribute or how they would interpret his proposed language describing the likelihood of manifesting the alleged defect (e.g., "failure rate"). While Mr. Boedeker claims that the purpose of his pre-test was to identify attributes of importance to aid in the design of his proposed CBC study,[57] any such study used in this matter would necessarily include some representation of the nature of the claimed defect and its frequency of occurrence. The failure to investigate respondents' understanding(s) of the concepts of the alleged "audio defect," "propensity for failure" or "failure rate" underscores the lack of evidence regarding the reliability of Mr. Boedeker's proposed survey methodology.

C. MR. BOEDEKER'S PROPOSED CONJOINT SURVEY METHODOLOGY FAILS TO REPLICATE MARKETPLACE CONDITIONS

43.   A key consideration when designing a conjoint study is whether the study offers a realistic approximation of the marketplace context in purchasing decisions are made for the product(s) at issue. Failing to replicate marketplace conditions can lead to hypothetical bias, such that respondents' selections in a hypothetical choice scenario (e.g., a CBC choice exercise) differ from what they would do in a real-life purchasing situation.[58] This type of bias is more likely to occur in

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[57] Boedeker Report, ¶62.

[58] Orme and Chrzan 2017, p. 11.

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studies where a primary objective is to determine respondents' willingness to pay for product features

or options.[59] As Orme and Chrzan note,

> [T]he survey research environment can differ from the environment in which market choices occur. The change in context to the survey environment can change both the complexity of the decision process and the consequentiality of the decision, leading survey respondents to adopt different decision rules in surveys than they do when making corresponding real-world decisions.[60]

> In general, anything we can do to make our research design resemble the real world will prepare respondents to provide realistic answers- at a minimum making our questionnaire stimuli realistic so that we don't actively remind respondents that they're "just" taking a survey.[61]

44.   Putting aside the fact that Mr. Boedeker has not provided any evidence that respondents

to his proposed study would interpret his key attribute in a way that is consistent with Plaintiffs' case

theory, Mr. Boedeker's failure to reasonably replicate how consumers would encounter the accused

devices in the marketplace means that the values calculated from his proposed conjoint study would

not necessarily reflect the values consumers would assign to the accused Pixel devices if presented as

they would appear in real life.

45.   Of particular concern here is with regard to how attributes and attribute levels would

be presented to respondents in Mr. Boedeker's proposed CBC study, and the potential for focalism

bias. Literature on consumer decision making describes focalism as a type of bias that occurs when

respondents pay more attention to a product attribute in a survey setting (e.g., a CBC choice exercise)

than they ordinarily would in an actual purchasing situation. This can lead to inflated values from the

conjoint study, as it tends to increase the relative subjective value respondents assign to the attribute

at issue.[62]

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[59] Orme and Chrzan 2017, p. 13.

[60] Orme and Chrzan 2017, p. 9.

[61] Orme and Chrzan 2017, p. 13.

[62] As Professor Häubl and colleagues note, "**Focalism**. Research in psychology has shown that people tend to overweight whatever information is most salient or most accessible at a particular moment and neglect other relevant considerations." [Emphasis in original. Internal citations omitted.] In addition, the results of two experiments

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46.   It is likely that the results of a CBC study conducted using Mr. Boedeker's proposed survey methodology would be plagued by focalism bias. This is because respondents would be essentially forced to consider attributes relating to the "audio defect" in isolation from key contextual information that is readily available in the actual marketplace. Literature on consumer decision making suggests that, when attributes are displayed in a way that draws undue attention or omits that which would have been potentially salient in the marketplace, the results from a conjoint analysis are more likely to be inflated or unrealistic.[63] There are several key areas of concern in this matter.

47.   ***Failure to include realistic pricing options***. Mr. Boedeker notes, "in order to estimate a demand curve for the Pixel Phones for which the Defect would be disclosed at the point of purchase, both prices below and above the price points common in the market have to be included."[64] Yet, it is unclear whether Mr. Boedeker's proposed price attribute would include the full range of prices consumers actually paid for the devices at issue at the time of purchase.

48.   First, it appears that Mr. Boedeker based the levels (or options) of his proposed price attribute on a review of retail prices for Google's smartphones,[65] which apparently did not include the

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conducted by the research team suggest that, "in making product comparison decisions during sequential search, consumers are unduly influenced by the attractiveness of the currently inspected product, at the expense of all others (focalism effect)." See p. 441 and 439 (respectively) in Häubl, G., Dellaert, B. G., and Donkers, B. (2010). "Tunnel Vision: Local Behavioral Influences on Consumer Decisions in Product Search." *Marketing Science*, 29(3):438-455.

[63] Professor Posavac and colleagues explain, "[t]he literature suggests the importance of providing clear, complete descriptions of the entity being valued prior to respondents indicating their valuations. The target entity's attributes are often presented in isolation or in greater detail compared with other entities."   The research team designed two experiments to determine whether selective exposure can lead to overestimated values for features being tested. The results suggest that "(a) when an [] entity is the focus of assessment in a survey, positively biased evaluations often result; (b) positivity bias in evaluation translates to real monetary allocation decisions; and (c) selective information processing contributes to these effects." See p. 43 in Posavac, S.S.; Brakus, J.J.; Jain, S.P.; Cronley, M.L. (2006). "Selective Assessment and Positivity Bias in Environmental Valuation." *Journal of Experimental Psychology: Applied*, Vol 12(1):43-49.

[64] Boedeker Report, ¶114.

[65] Boedeker Report, ¶115.

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actual prices for the Pixel and Pixel XL devices at issue.[66] Moreover, I understand that the amount a consumer would have paid at the time of purchase for a Pixel or Pixel XL varied depending on whether the device was purchased at the suggested retail price, as part of an individual or family plan, and/or during a sale or promotion, which could include, for example, varying amounts of credit for trading in an older phone, reduced monthly payments and gifts with purchase.[67]

49.   Second, Mr. Boedeker proposes to ask respondents to assume they would pay full price for a smartphone in a single payment, but evidence from his own pre-test survey suggests that this is outside of the marketplace experience for most consumers. Notably, although Mr. Boedeker claims that "[t]he majority (55%)"[68] purchased a smartphone at full price, his own analysis indicates that approximately 45 percent of respondents to his pre-test did not pay full price.[69] Moreover, additional analysis of Mr. Boedeker's pre-test data reveals that less than half of Android purchasers' responses indicate that they paid the full retail cost of the device in a single payment (approximately 49 percent).[70] In fact, responses to Mr. Boedeker's pre-test survey indicate that the majority of Android purchasers (approximately 51 percent) received a discount and/or financed/leased their most recently purchased device through a long-term commitment.[71]

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[66] Boedeker Report, ¶115; see also footnote 61 and Figure 17.

[67] GOOG-WEEKS-0038851, GOOG-WEEKS-0038863, GOOG-WEEKS-00038873, GOOG-WEEKS-00039037, GOOG-WEEKS-00039371, GOOG-WEEKS-00039116, GOOG-WEEKS-00039535, GOOG-WEEKS-00039223, GOOG-WEEKS-00039345, GOOG-WEEKS-00039392, GOOG-WEEKS-00039418, GOOG-WEEKS-00039434, GOOG-WEEKS-00039795, GOOG-WEEKS-00039810.

[68] Boedeker Report, ¶105 and Figure 13.

[69] Boedeker Report, ¶105 and Figure 13.

[70] Specifically, these respondents were Android purchasers who met Mr. Boedeker's qualifying criteria (Boedeker Report, ¶97 and Smartphone Pre-Survey.docx) and who indicated that they purchased at full price and did not indicate that they received a discount (e.g., due to trade in or promotion) or that they purchased, rented to own, leased or financed the phone as part of a long-term commitment, contract or monthly service plan. See AndroidSurveyData102218.xlsx, q18.

[71] Specifically, these respondents were Android purchasers who met Mr. Boedeker's qualifying criteria (Boedeker Report, ¶97 and Smartphone Pre-Survey.docx) and who indicated that they received a discount (e.g., due to trade in

50.   These findings mirror the situations of some named Plaintiffs. For example, Plaintiff McCloy testified that he received a discount as an upgrade or in exchange for a trade-in[72] and has never paid cash upfront for the full purchase price of any phone.[73] Similarly, Plaintiff Alcaraz testified that he received a $15 per month discount after signing a two-year contract with Verizon.[74]

51.   Moreover, while Mr. Boedeker did not ask any question about the amount(s) respondents paid for their phones, some respondents to his pre-test survey indicated in an open-ended response field that they acquired their most recent phones for free or received a 50 percent discount. For example, 5 respondents to Mr. Boedeker's pre-test indicated that their phone was "free" or that they received the device at "no charge."[75] Likewise, 5 respondents indicated that they "paid half price" and/or got their phones for 50 percent off or as part of "buy one get one" promotion.[76]

52.   The manner in which price is presented to respondents likely has implications for the product selections they would make in the choice sets. To the extent that there is a subset of consumers who would only purchase smartphones after receiving a significant discount and/or if given the option to make payments within a certain range (e.g., rather than pay all at once for the full retail cost of the phone), Mr. Boedeker's proposed survey methodology (i.e., providing options that assume *all* respondents would pay full retail value in a lump sum) will be unreliable as an indicator of the selections this group of consumers would make in the actual marketplace.   For example,

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or promotion) and/or that they purchased, rented to own, leased or financed the phone as part of a long-term commitment, contract or monthly service plan. See AndroidSurveyData102218.xlsx, q18.

[72] Videotaped Deposition of Brian McCloy, San Francisco, California, Monday, December 17, 2018, Volume I ("McCloy Deposition"), 50: 17 – 51: 15.

[73] McCloy Deposition, 78: 10-14.

[74] Transcript of the Testimony of Adrian Alcaraz, Weeks v. Google LLC, December 10, 2018, Volume I ("Alcaraz Deposition"), 60:21 – 61: 20.

[75] AndroidSurveyData102218.xlsx, Respondent IDs: 10, 115, 158, 230, 354.

[76] AndroidSurveyData102218.xlsx, Respondent IDs: 24, 35, 103, 423, 456.

Plaintiff Alcaraz testified that his purchase decision was influenced by monthly payment offerings available from Verizon:

> At the time [the Pixel was under consideration] my recollection is that there were three phones that Verizon was offering for the monthly payment to be $20 a month for the life of the phone. Among those phones was the Google Pixel and the iPhone that – which was its competition at the time.[77]

Thus, without including realistic pricing options, it is unlikely that Mr. Boedeker's proposed study would reliably replicate the decisions these consumers would make in a real purchasing situation. As such, there is no guarantee that the results based on data from Mr. Boedeker's proposed study would reasonably reflect the marketplace conditions consumers encountered when purchasing smartphones such as the Pixel devices or reliably measure the subjective value consumers assign to (e.g., their willingness to pay for) the devices at issue as they relate to Plaintiffs' claims.

53.   Further adding to his unrealistic approach to pricing, Mr. Boedeker's proposed survey methodology sets up a scenario in which respondents are instructed: "*You have already settled on the design and brand and have chosen a model for $700. You intend to buy this phone at the retail price. The model for $700 has the following features*[]".[78] Mr. Boedeker's proposed phrasing here is problematic, as it would likely suggest to respondents that the desired response is to indicate that they would purchase a $700 device at its full retail price, even if this is not in line with their preferences or something they would ever consider in a real-life purchasing situation.

54.   Moreover, it is unclear whether instructing respondents to assume that they have "already settled on"[79] a smartphone priced at $700 and "intend to buy this phone at the retail price"[80] would be appropriate for the relevant population as Mr. Boedeker has defined it. First, data from Mr.

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[77] Alcaraz, Deposition, 50: 8 – 51: 5.

[78] Italics in original. Boedeker Report, ¶111. See also Android Conjoint Draft Survey, p. 7.

[79] Italics in original. Boedeker Report, ¶111. See also Android Conjoint Draft Survey, p. 7.

[80] Italics in original. Boedeker Report, ¶111. See also Android Conjoint Draft Survey, p. 7.

Boedeker's own pre-test show that the majority of Android purchasers received a discount or financed/leased their devices via long-term contracts.[81]   Second, Mr. Boedeker has indicated that the population for his proposed study would not be limited to Pixel purchasers.[82]   Yet, there is no indication that Mr. Boedeker reviewed prices for any smartphones other than Pixel 2 and 3 devices.[83] In addition, Mr. Boedeker did not ask any question in his pre-test to determine the prices respondents actually paid for smartphones.

55.   Mr. Boedeker's instruction that respondents should assume that they have "already settled on" a specific product configuration and price point[84] is also problematic because it is likely to produce biased results due to anchoring. As Dillman and colleagues explain, anchoring occurs when "early [information] set[s] a standard to which later questions are compared".[85]   For example, in this instance, Mr. Boedeker's proposed instructions would likely create a situation in which respondents use $700 as the standard to which they evaluate all of the other prices they are shown in the choice sets, regardless of whether they would ever actually consider purchasing a $700 smartphone in real life. Here again, there is no guarantee that any estimates of consumers' subjective valuations (e.g., willingness to pay) that are based on data from Mr. Boedeker's proposed study would reflect consumers' true preferences or likely purchasing behavior for the devices at issue as they relate to Plaintiffs' claims.

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[81] Specifically, 51 percent of Android purchasers who met Mr. Boedeker's qualifying criteria (Boedeker Report, ¶97 and Smartphone Pre-Survey.docx) indicated that they received a discount (e.g., due to trade in or promotion) and/or that they purchased, rented to own, leased or financed the phone as part of a long-term commitment, contract or monthly service plan. See AndroidSurveyData102218.xlsx, q18.

[82] Boedeker Report, ¶109.

[83] Boedeker Report, ¶115 and Figure 17.

[84] Italics in original. Boedeker Report, ¶111. See also Android Conjoint Draft Survey, p. 7.

[85] Dillman, D., Smyth J., and Christian, L. 2014. *Internet, Phone, Mail and Mixed-Mode Surveys: The Tailored Design Method, 4th Ed.* Hoboken, New Jersey: John Wiley & Sons, Inc. Kindle Edition, p. 234.

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56. ***Failure to consider the potential influence of Google's brand***. Despite evidence from his pre-test showing brand as the third most important feature for Android smartphone purchasers, Mr. Boedeker does not intend to include brand as an attribute in his proposed CBC study.[86] In this case, brand is arguably an important part of replicating the marketplace conditions in which consumers decided whether or not to purchase the Pixel devices at issue.

57. Plaintiffs note that the Pixel phones at issue were marketed as "premium" devices intended to compete with the iPhone.[87] Likewise, Google's brand is mentioned in the marketing materials for the Pixel devices at issue. For example, Plaintiffs note, "[b]efore purchasing their Pixels, all Plaintiffs visited Google's dedicated Pixel web page".[88] On this page, the Pixel device is referred to as a "[p]hone by Google."[89] Similarly, Plaintiffs note that, "[p]rior to using their Pixels, Plaintiffs encountered Google's external packaging of the Pixel".[90] Google's brand logo and the phrase "[p]hone by Google" appear on the front of the external packaging for the Pixel, as shown in the image below.[91]

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[86] Boedeker Report, ¶109.

[87] Second Amended Complaint, ¶59.

[88] https://web.archive.org/web/20161005090908/https:/store.google.com/product/pixel_phone, Second Amended Complaint, ¶66 and footnote 21.

[89] https://web.archive.org/web/20161005090908/https:/store.google.com/product/pixel_phone, last visited January 7, 2019.

[90] Second Amended Complaint, ¶68.

[91] https://www.ebay.com/itm/Original-Empty-Retail-Packaging-Box-w-Tray-for-Google-Pixel-XL-5-5-Silver-32GB-/142536021370, last visited January 23, 2019.

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58.   The potential salience of brand is also evident in deposition testimony of named plaintiffs, two of whom suggest that their purchase decisions were influenced by perceptions of Google as an entrant into the smartphone market and the fact that Pixel devices were offered with certain Google-exclusive features. For example, Plaintiff McCloy testified "it was the [Google] brand that

really did it for me."[92]   Plaintiff McCloy testified that he was excited that Google was "disrupting the

market in relation to the iPhone"[93] and he wanted to be "an early adopter"[94] of a new and innovative

device.[95]   Similarly, Plaintiff Alcaraz testified that Google-specific features factored into his decision

to purchase a Pixel XL, including Google account integration, unlimited full resolution photo storage[96]

and unlimited access to the Google Cloud.[97]   Plaintiff Alcaraz further testified that he believed the

Pixel XL was superior to the iPhone because "it was an Android Google phone."[98]

59.   By failing to include brand, it is unlikely that the results of Mr. Boedeker's proposed

study would reasonably approximate the marketplace context in which consumers purchased the Pixel

devices at issue. Mr. Boedeker has indicated that the relevant population for his proposed study would

not be limited to Pixel purchasers,[99] and there is no indication that respondents would be told that they

are choosing among Pixel devices. As proposed, Mr. Boedeker's study may capture the delta between

two generic smartphones with and without an "audio defect" but would be unable to account for the

effects of Google's brand on respondents' selections (if any). Moreover, setting aside the issue of

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[92] McCloy Deposition, 69: 13-18.

[93] McCloy Deposition, 69: 19 – 70: 15.

[94] McCloy Deposition, 70: 7-19.

[95] McCloy Deposition, 70: 7-19

[96] Alcaraz Deposition, 50: 8-16. See also 54: 21 – 55:8.

[97] Alcaraz Deposition, 58: 14 – 59:8. See also 55: 9-20.

[98] Alcaraz Deposition, 50: 8-16.

[99] The Boedeker Report states that the population would not be limited to those who purchased Pixel devices, due to concerns of insufficient sample size. While Mr. Boedeker acknowledges that brand could potentially be an important variable, he claims he does not want to include brand for fear of tipping off respondents about the purpose of the study (Boedeker Report, ¶109). The rationale for this is unclear because, as noted earlier, "audio defects" (or lack thereof) are generally not part of the marketing to consumers when evaluating smartphones. Thus, the mere presence of the proposed "audio defect" attribute would likely be enough to cause at least some respondents to guess that the study was being conducted about a smartphone with a potential audio defect. Thus, despite Mr. Boedeker's claim that his study would be conducted "double blind" there is reason to believe that at least some consumers would guess the purpose of the study and that this could potentially influence their responses. When respondents know the purpose of a study, they may wittingly or unwittingly alter their behavior (Diamond 2011, pp. 410-411).

whether respondents would be able to understand and meaningfully differentiate between the various levels of the proposed "audio defect" attribute, any willingness to pay value that is calculated using data from Mr. Boedeker's proposed survey methodology (e.g., for a device with "no defect" versus some other level of the proposed "defect" attribute) would <u>not</u> be tied to an accused Pixel device. Rather, because respondents would not be instructed to assume that they would be choosing among Pixel devices, the resulting value would be an average across all smartphone brands or all Android brands (as assumed by respondents) and would not specifically represent the difference in value (if any) for the Pixel phones at issue with versus without the alleged audio defect.

60.   ***Failure to depict the devices as they appear in the marketplace.***   In both of the study designs Mr. Boedeker has put forward, he proposes to present respondents with text-based descriptions of hypothetical smartphone configurations. Respondents to Mr. Boedeker's proposed study would never have the opportunity to view images of the devices. This does not replicate the way consumers would have actually encountered the Pixel devices at issue in the marketplace for smartphones.

61.   For example, images of Pixel phones appear in marketing materials viewed by Plaintiffs, including Google's Pixel web page and external packaging.[100] The potential salience of images of the devices in the marketing for the Pixel is also evident in the deposition testimony of Plaintiff Helms, who testified that she viewed a Facebook advertisement for the Pixel, which contained only a picture of the phone and a price.[101] She further testified that the look and feel of a smartphone is important to her.[102]

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[100] https://web.archive.org/web/20161005090908/https:/store.google.com/product/pixel_phone, Second Amended Complaint, ¶66 and footnote 21.

[101] Videotaped Deposition of Alicia Helms, San Francisco, California, Tuesday, November 20, 2018, Volume I ("Helms Deposition"), 77: 14 – 78: 17.

[102] Helms Deposition, 93: 15-16.

62.   ***Failure to provide any information regarding brand, operating system or carrier***.

Setting aside the issue of whether or not brand is included as an attribute, Mr. Boedeker fails to provide

any instruction to respondents regarding what (if anything) they should assume about the brand,

operating system or wireless provider of the devices that would be offered in his choice sets. This

information would be readily available in the marketplace, and absent any instruction, respondents

will likely make their own assumptions about these features.   For example, some may assume that

they are evaluating devices made by the same manufacturer and/or through the same carrier. Others

may assume they are evaluating Android phones from different manufactures and/or offered through

different carriers.   Here again, without knowing what assumptions respondents are making, there is

no guarantee that any resulting willingness to pay value would be tied to the devices at issue.

D. THE BOEDEKER REPORT FAILS TO PROVIDE CRITICAL DETAILS FOR ASSESSING SURVEYS USED FOR LITIGATION

63.   The Reference Guide notes that the following issues are important considerations for

any survey designed for use in litigation:

- The definition of the relevant population;
- The procedures for sampling from the relevant population;
- The survey questions used and interviewing procedures;
- The nature of the specific test and control stimuli shown to sampled consumers and;
- The protocol for calculating the results from the survey.[103]

64.   The Boedeker Report is incomplete with regard to specifically what he is proposing,

and he ignores many critical issues which his proposed procedures would need to address before any

reasonable conclusion about the ultimate reliability of such a process could be rendered. Despite his

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[103] Diamond 2011. The *Manual for Complex Litigation, Fourth Edition* phrases these key areas as such:

- The population was properly chosen and defined;
- The sample chosen was representative of that population;
- The data gathered were accurately reported; and
- The data were analyzed in accordance with accepted statistical principles.

See p. 103 in Manual for Complex Ligation, Fourth Edition. 2004. Federal Judicial Center.

lengthy yet very general discussion of the process by which CBC questionnaires are designed, administered and analyzed, the Boedeker Report provides very little in the way of specific details of the actual survey methodology he would use in this case.

65.   **Population**. Mr. Boedeker defined the relevant population for his pre-test as Android purchasers.[104] The Boedeker Report suggests that the population for his proposed CBC study would also be Android purchasers (i.e., not limited to Pixel purchasers due to sample size issues) but does not say conclusively that this would be the case.[105] However, the screening questions provided in the Android Conjoint Draft Survey that was produced after the Boedeker Report indicate that the population would not be limited to Android users.[106] If Mr. Boedeker intends to expand the relevant population for his proposed CBC study beyond Android purchasers, it is unclear whether he intends to calculate willingness to pay results on the entire population of smartphone purchasers (e.g., as identified in the Android Conjoint Draft Survey[107]) or whether he would limit the results to the subset of respondents who are Android purchasers, or some other group. Moreover, the effect of instructing respondents that they would be choosing among "Android" phones (as proposed in the Android Conjoint Draft Survey[108]) may differ depending on whether or not the survey population would be limited to Android purchasers.

66.   **Sampling**. As the Reference Guide explains, "[i]dentification of a survey population must be followed by selection of a sample that accurately represents that population."[109] Here again, despite a lengthy yet very general discussion about surveys conducted using internet panels and his

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[104] Boedeker Report, ¶¶96-97.

[105] Boedeker Report, ¶109.

[106] Android Conjoint Draft Survey, pp. 4-5.

[107] Android Conjoint Draft Survey, pp. 4-5.

[108] Android Conjoint Draft Survey, p. 7.

[109] Diamond 2011, p. 380.

preferred online panel provider, Mr. Boedeker provides very little specific information regarding how he would ensure his sample would be representative of the relevant population in this matter. For example, it is unclear whether Mr. Boedeker intends to use the same sampling process used when conducting his pre-test, and if so, how he would determine whether this sample would reasonably represent the views of consumers who purchased the Pixel devices at issue. I understand there are two devices at issue: Pixel and Pixel XL.[110] It is unclear whether Mr. Boedeker has done any research to determine whether there are differences between Pixel versus Pixel XL purchasers. Even so, Mr. Boedeker provides no discussion of whether or how he would obtain a representative sample of each group.

67.   Moreover, I understand that Pixel and Pixel XL devices were available for purchase through Google's Play Store (online) as well as through Verizon Wireless (online and store locations).[111] However, Mr. Boedeker did not include a question in his pre-test regarding the sales channels through which respondents purchased their smartphones, and it appears that he has not attempted to determine whether there are differences among groups of consumers based on the sales channel and/or carrier through which they purchased their Android phones. For example, he testified that he has not looked into the different sales channels for the Pixel because he believes this is not relevant for his damages analysis, as he intends to "model[] the demand curves across the entire price range that is defined by the price points" in his proposed conjoint study.[112] Setting aside the issues noted above about Mr. Boedeker's failure to replicate marketplace conditions relating to pricing, this raises concerns regarding whether or not the pool of respondents to Mr. Boedeker's proposed CBC

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[110] Motion for Class Certification, 1:5-6.

[111] See, for example, Second Amended Complaint, ¶16, ¶24, ¶33, and ¶44.

[112] Video-Recorded Deposition of Expert Stefan Boedeker, Los Angeles, California, Thursday December 20, 2018, 100: 1-17.

study would be representative of the relevant population, as Mr. Boedeker fails to provide any assurance that his sample would include a representative mix of consumers who purchased their devices through various sales channels.

68.   **Survey Questions and Attributes**.   The Boedeker Report fails to include the actual survey questionnaire that will be used. The closest it comes is the illustrative example presented in Figure 16, which Mr. Boedeker acknowledges is incomplete with respect to the specific levels that would define the attributes included in his proposed study.[113]   As noted above, I understand that, following the Boedeker Report, Mr. Boedeker produced a draft questionnaire for his proposed conjoint study (Android Conjoint Draft Survey).   However, there are differences between the survey methodology outlined in the Android Conjoint Draft Survey as compared to the Boedeker Report, and it is unclear whether the Android Conjoint Draft Survey is intended to supersede the survey methodology proposed in the Boedeker Report, or if it was offered as an alternative. Likewise, it is unclear whether the attribute descriptions presented in the Android Conjoint Draft Survey[114] are a complete list of the options that would be presented to respondents, an illustrative example and/or an alternative to the survey methodology that is presented in the Boedeker Report.

69.   Moreover, Mr. Boedeker is silent on whether or how he intends to account for differences between Pixel and Pixel XL in his proposed study. For example, it is unclear whether or how Mr. Boedeker intends to estimate results separately for product configurations approximating Pixel versus Pixel XL devices, as neither of his proposed CBC studies appear to include attribute levels that correspond to Pixel XL. Specifically, I understand that the Pixel XL was shown on Google's

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[113] Regarding Figure 16, Mr. Boedeker notes, "[e]ach screen shows randomly selected levels for each attribute. Therefore, Figure 16 does not necessarily show all levels for each attribute." Boedeker Report, ¶112.

[114] Android Conjoint Draft Survey, pp. 9-12.

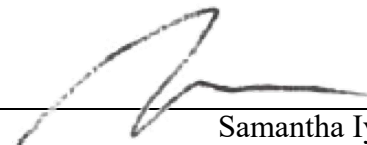Pixel web page as having an "[i]mmersive **5.5" AMOLED QHD (2560 x 1440) 534ppi display**".[115] Yet, neither the Boedeker Report nor the Android Conjoint Draft Survey include a screen size option that is comparable to the specifications of the Pixel XL.[116]

VII.   CONCLUSIONS

70.   I was asked as a survey expert with expertise in the design and analysis of conjoint surveys to evaluate Mr. Boedeker's proposed design and use of a conjoint survey in this matter. Based on my review of the details that were provided in the Boedeker Report and associated production, it is my opinion that, given the facts of the case, Mr. Boedeker's proposed conjoint survey methodology will not produce reliable results for use in estimating consumers' subjective preferences or their willingness to pay for the Pixel devices at issue with and without the "audio defect" as alleged by Plaintiffs. Moreover, Mr. Boedeker provides no more than a very superficial overview of his proposed approach and fails to provide many important details that would need to be considered before one could determine that his survey methodology was likely to yield reliable results.

71.   My opinions and conclusions as expressed in this report are to a reasonable degree of professional certainty. My work is ongoing and my opinions will continue to be informed by any additional material that becomes available to me.

Executed this 23 day of January, 2019, in Fishkill, NY.

Samantha Iyengar

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[115] Emphasis in original. https://web.archive.org/web/20161005090908/https:/store.google.com/product/pixel_phone, last visited January 7, 2019.

[116] Specifically, the Boedeker Report and the Android Conjoint Draft Survey include the following screen size options: (1) 5-inch (130 mm) AMOLED display panel with 1920×1080 resolution; or (2) 6-inch (150 mm) P-OLED display panel with 2880×1440 resolution (Boedeker Report, p. 41 and Figure 16; Android Conjoint Draft Survey, pp. 7, 9, 12 and 13).

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Exhibit A

NERA
Economic Consulting

National Economic Research Associates, Inc.
1166 Avenue of the Americas
New York, NY 10036
Direct + 1 212 345 3788
Samantha.Iyengar@NERA.com
www.nera.com

SAMANTHA IYENGAR, Ph.D.

SENIOR CONSULTANT

Dr. Iyengar is a Senior Consultant based in NERA's New York City office. She specializes in survey research, sampling, and statistical analysis, and has applied her expertise to matters involving class action, intellectual property and other litigation, as well as market research and criminal justice issues. Dr. Iyengar's work has involved survey design and application, sample design and estimation, and data management and analysis.

Dr. Iyengar has worked on a variety of survey and sampling litigation projects, including false advertising, purchase and use behaviors, likelihood of confusion, patent issues, wage and hour, and other issues involving consumer perceptions and behavior. She has submitted expert reports relied upon in mediation and litigation matters and offered testimony at deposition. She also has experience using discrete choice methodology, such as conjoint and MaxDiff surveys, to quantify consumer demand for particular characteristics and features that make up individual products or services.

Dr. Iyengar previously applied her survey research expertise on a number of projects, including an institutional quality assessment and statistical analyses of labor market indicators, and violent crime and imprisonment rates using data from the Bureau of Justice Statistics (including the National Crime Victimization Survey), US Census, and other government surveys.

Dr. Iyengar previously served as an Assistant Professor of Criminal Justice at the University of Michigan-Flint and Assistant Professor of Sociology at the University of Idaho. She taught courses including Methods of Social Research, Introduction to Criminal Justice, Corrections, Juvenile Delinquency, and Criminological Theory.

Education

University of Iowa
Ph.D., Sociology, (2012)
M.A., Sociology, (2008)

University of Montana
M.A., Sociology, (2007)
B.A., Sociology and Anthropology, (2005)

Professional Experience

	NERA Economic Consulting
2018-Present	Senior Consultant
2014-2018	Consultant

University of Michigan–Flint

2013-2014   Assistant Professor, Department of Sociology, Anthropology & Criminal Justice

University of Idaho

2012-2013   Assistant Professor, Department of Sociology & Anthropology

University of Iowa

2011-2012   Ballard and Seashore Dissertation Fellow
2007-2011   Research and Teaching Assistant, Department of Sociology

University of Montana

2006-2007   Research Assistant, Department of Academic Affairs
2005-2006   Research and Teaching Assistant, Department of Sociology

Testimony

(Retaining party underlined)

Republic Technologies (NA), LLC and Republic Tobacco, L.P. v. *BBK Tobacco & Foods, LLP d/b/a HBI International, United States District Court, Northern District of Illinois*— Expert report on a survey regarding consumer perceptions of statements on tobacco accessories in a misleading advertising dispute (Report: April 2018; Deposition: May 2018).

Representative Project Experience

Assisted in critiquing a proposed conjoint study regarding smartphones [product liability].

Retained as a consulting expert to conduct a conjoint study regarding consumer preferences for tablet devices [product liability].

Retained as a consulting expert to perform statistical analysis in response to proposed regulation [product liability].

Retained as a consulting expert to perform statistical analyses of data from a large sample government survey [product liability].

Assisted in conducting a conjoint study regarding appliances [product liability].

Assisted in conducting a hypothetical choice study regarding an automotive recall [product liability].

Assisted in conducting a MaxDiff survey regarding snack foods [product liability].

Assisted in critiquing a proposed conjoint study regarding health insurance products [product liability].

Assisted in analyzing data from a conjoint study regarding sports vehicles [product liability].

Assisted in critiquing a contingent valuation study regarding a personal care product [product liability].

Retained as a consulting expert to conduct a MaxDiff study related to consumer preferences for paint products [commercial market research].

Retained as a consulting expert to conduct surveys relating to consumer preferences for household linen products and submitted an affirmation that was relied upon in mediation [false advertising].

Assisted in conducting a conjoint survey regarding computer networking equipment [patent].

Assisted in critiquing a conjoint study regarding a buttery spread product [false advertising].

Assisted in conducting a likelihood of confusion survey regarding vision care products [competition].

Assisted in conducting a survey regarding healthcare benefit manager decision making [competition].

Assisted in conducting a likelihood of confusion survey regarding online searches for charities [trademark].

Assisted in conducting a false advertising survey regarding ingredients in baked goods products [false advertising].

Assisted in critiquing a survey regarding medical prescriber decision making [patent].

Assisted in conducting a conjoint study concerning a proposed brand acquisition [commercial market research].

Assisted in critiquing a likelihood of confusion survey regarding action cameras [design patent].

Retained as a consulting expert to conduct a survey regarding consumers expectations for a rewards program [false advertising].

Assisted in conducting a likelihood of confusion survey regarding medical implants [trade dress].

Assisted in critiquing a contingent valuation study regarding food service ingredients [false advertising].

Assisted in critiquing a conjoint study regarding fruit juice beverages [false advertising].

Assisted in critiquing a conjoint study regarding beverage products [false advertising].

Assisted in critiquing a conjoint study regarding energy drinks [false advertising].

Assisted in critiquing a proposed conjoint study regarding e-cigarettes [false advertising].

Assisted in conducting a likelihood of confusion study regarding dairy products [trade dress].

Assisted in critiquing a conjoint study regarding a cooking oil product [false advertising].

Assisted in conducting a consumer perception survey, as well as critiquing an opposing survey regarding substitutability in beverage product options [false advertising].

Assisted in conducting a consumer perception survey regarding non-functional slack-fill and ingredients of prepared food products [false advertising].

Assisted in conducting a likelihood of confusion study regarding a confectionery product [trade dress].

Assisted in analyzing data from a conjoint study regarding a cable television feature [patent].

Assisted in critiquing a discrete choice survey regarding auto repair options [false advertising].

Assisted in critiquing a conjoint survey regarding carbonated beverages [false advertising].

Assisted in analyzing data from a MaxDiff survey regarding footwear [patent].

Assisted in critiquing a focus group study regarding a beverage product [false advertising].

Assisted in critiquing a proposed conjoint study regarding baked goods [false advertising].

Assisted in the design and selection of a sample of household products [false advertising].

Presentations and Publications (10 years)

"Class Certification and Damages in Consumer Class Actions: Conjoint Survey and Hedonic Regression" (co-presenter) CLE at NERA New York, April 20, 2016.

"The Use of Surveys and Sampling in Intellectual Property and Class Action Litigation" CLE at Blakes, Toronto, ON. October 29, 2015.

"Crime and Gender." 2015. (co-author) *International Encyclopedia of Social and Behavioral Sciences, 2nd edition*. Oxford, UK: Elsevier.

"Book Review: Breaking Women: Gender, Race, and the New Politics of Imprisonment. By Jill A. McCorkel." 2014. *Gender & Society*, 28: 789-791.

"Patterns of Educational Disadvantage and Imprisonment by Race: A Macro-Level Analysis" at the 2014 Annual Meeting of the American Society of Criminology.

"Gender and Theories of Delinquency." 2013. (co-author) *Oxford University Handbook of Criminological Theory*. Edited by Pamela Wilcox and Francis Cullen. Oxford, UK: Oxford University Press.

"The Effects of Labor Market Opportunities, Minority Group Presence and Political Ideology on Imprisonment Rates" at the 2012 Annual Meeting of the Academy of Criminal Justice Sciences.

"Economic Disadvantage, Welfare Spending, and Gendered Arrests for Violence: An Analysis of Cities, 1970-2000" (co-presenter) at the 2010 Annual Meeting of the American Society of Criminology

Grants and Fellowships

Dissertation Improvement Grant, National Science Foundation (2011 – 2012)

Ballard Seashore Dissertation Fellowship, University of Iowa (2011 – 2012)

Quantitative Data Analysis Fellowship, Bureau of Justice Statistics (Summer 2011)

Professional Affiliations

Member, American Association for Public Opinion Research (AAPOR), American Statistical Association (ASA)

January 2019

Exhibit B

Documents from Counsel

- Expert Report of Stefan Boedeker

- Second Amended Class Action Complaint

- Plaintiffs' Notice of Motion and Motion for Class Certification, and Memorandum of Law in Support Thereof

- Android Conjoint Draft Survey

- GOOG-WEEKS-0038851, GOOG-WEEKS-0038863, GOOG-WEEKS-00038873, GOOG-WEEKS-00039037, GOOG-WEEKS-00039371, GOOG-WEEKS-00039116, GOOG-WEEKS-00039535, GOOG-WEEKS-00039223, GOOG-WEEKS-00039345, GOOG-WEEKS-00039392, GOOG-WEEKS-00039418, GOOG-WEEKS-00039434, GOOG-WEEKS-00039795, GOOG-WEEKS-00039810

- AndroidSurveyData102218.xlsx

- Smartphone Pre-Survey.docx

- Videotaped Deposition of Brian McCloy, San Francisco, California, Monday, December 17, 2018, Volume I

- Transcript of the Testimony of Adrian Alcaraz, Weeks v. Google LLC, December 10, 2018, Volume I

- Videotaped Deposition of Alicia Helms, San Francisco, California, Tuesday, November 20, 2018, Volume I

- Video-Recorded Deposition of Expert Stefan Boedeker, Los Angeles, California, Thursday December 20, 2018

Others

- Allenby, G., Rossi, P., Cameron, L., and Li, Y. 2017. "Computing Damages in Product Liability Mislabeling Cases: Plaintiffs' Mistaken Approach in *Briseno v. Conagra*." *Product Safety & Liability Reporter*, 45 PSLR 208.

- Orme, B. 2014. *Getting Started with Conjoint Analysis, 3rd Edition.* Manhattan Beach, CA: Research Publishers LLC.

- Diamond, Shari S. 2011. "Reference Guide on Survey Research," in Reference Manual on Scientific Evidence, Third Edition, Federal Judicial Center.

- Weisberg, H. 2005. *The Total Survey Error Approach: A Guide to the New Science of Survey Research.* Chicago: University of Chicago Press.

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- Ready, R., Champ, P., and Lawton, J. 2010. "Using Respondent Uncertainty to Mitigate Hypothetical Bias in a Stated Choice Experiment" *Land Economics*, 86(2):363-381.

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- Kolter, R. and Armstrong, G. 2012. *Principles of Marketing, 14th Edition*. Upper Saddle River, NJ: Prentice Hall.

- Orme, B. and Chrzan, K. 2017. *Becoming an Expert in Conjoint Analysis: Choice Modeling for Pros*. Orem, UT: Sawtooth Software.

- Allenby, G., Brazell, J., Howell, J., and Rossi, P. 2014. "Valuation of Patented Product Features." *Journal of Law and Economics*, 57(3): 629-663.

- Häubl, G., Dellaert, B. G., and Donkers, B. (2010). "Tunnel Vision: Local Behavioral Influences on Consumer Decisions in Product Search." *Marketing Science*, 29(3):438-455.

- Posavac, S.S.; Brakus, J.J.; Jain, S.P.; Cronley, M.L. (2006). "Selective Assessment and Positivity Bias in Environmental Valuation." *Journal of Experimental Psychology: Applied*, Vol 12(1):43-49.

- Dillman, D., Smyth J., and Christian, L. 2014. *Internet, Phone, Mail and Mixed-Mode Surveys: The Tailored Design Method, 4th Ed.* Hoboken, New Jersey: John Wiley & Sons, Inc. Kindle Edition, p. 234.

- https://web.archive.org/web/20161005090908/https:/store.google.com/product/pixel_phone, last visited January 7, 2019.

- https://www.ebay.com/itm/Original-Empty-Retail-Packaging-Box-w-Tray-for-Google-Pixel-XL-5-5-Silver-32GB-/142536021370, last visited January 23, 2019.

- Manual for Complex Ligation, Fourth Edition. 2004. Federal Judicial Center**.**

DECLARATION OF BOBBIE J. WILSON

EXHIBIT 26

(Redacted Version - Sought to be Sealed)

UNITED STATES DISTRICT COURT
NORTHERN DISTRICT OF CALIFORNIA
SAN JOSE DIVISION

PATRICIA WEEKS, ALICIA HELMS, BRIAN MCCLOY, and ADRIAN ALCARAZ, on behalf of themselves and all others similarly situated, Plaintiffs, v. GOOGLE LLC, Defendant.	Case No. 5:18-cv-00801-NC

DRAFT REBUTTAL REPORT OF DR. VIJAY MADISETTI

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A.   Qualifications

1.   I received my Bachelor of Technology (Honors) in Electronics and Electrical

        Communication Engineering at the Indian Institute of Technology (IIT) in Kharagpur,

        India, in 1984. I obtained my Ph.D. in Electrical Engineering and Computer Science at

        the University of California, Berkeley, in 1989. I received the Demetri Angelakos

        Outstanding Graduate Student Award from the University of California, Berkeley, and

        the IEEE/ACM Ira M. Kay Memorial Paper Prize in 1989.

2.   I am a tenured Professor in Electrical and Computer Engineering at Georgia Tech and

        currently serve as its representative to European Telecommunications Standards Institute

        (ETSI), the premier standards setting organization that creates standards for 3G/4G and

        5G mobile phones. I am knowledgeable and well-versed in the areas of wireless

        communications, microprocessor architecture, hardware, RF, cellular networks, ASIC

        design, computer engineering, electronic packaging, embedded systems, digital signal

        processing, ETSI protocols and procedures, and associated software and firmware design

        for wireless and telecommunications terminals and base stations in general and

        ETSI/3GPP/3GPP2 standards based cellular architecture and infrastructure in particular.

3.   I have created and taught undergraduate and graduate courses in hardware and software

        design for signal processing and wireless communication circuits at Georgia Tech for the

        past twenty years. I also have supervised the Ph.D. dissertations of over twenty engineers

        in the areas of computer engineering, signal processing, communications, rapid

        prototyping, and system-level design methodology, of which five have resulted in thesis

        prizes or paper awards. I have also graduated more than 20 Ph.D. students that now work

        as professors or in technical positions around the world.

4.   Additionally, I have been active in the areas of wireless communications, digital signal

        processing, electronic packaging, integrated circuit design (analog and digital), software

        engineering, system-level design methodologies and tools, and software systems.

5.   I have been the principal investigator ("PI") or co-PI in several active research programs in these areas, including DARPA's Rapid Prototyping of Application Specific Signal Processors, the State of Georgia's Yamacraw Initiative, the United States Army's Federated Sensors Laboratory Program, and the United States Air Force Electronics Parts Obsolescence Initiative. I have received an IBM Faculty Award and NSF's Research Initiation Award.

6.   I have designed several specialized computer and communication systems over the past two decades at Georgia Tech for tasks such as wireless audio and video processing and protocol processing for portable platforms, such as cell phones and PDAs. I have worked on designing systems that are efficient from performance, size, weight, area, and thermal considerations.

7.   I have developed courses and classes for the industry on these topics, and many of my lectures in advanced computer system design - developed under the sponsorship of the United States Department of Defense in the late 1990s - are available for educational use and have been used by several U.S. and international universities as part of their course work.

8.   I have been working in the area of wireless communications and signal processing since the early 1980s. Some of my recent publications in the area of design of wireless communications systems and associated protocols are listed in **Appendix A**.

9.   In the 1980s, I designed and prototyped a very low RF frequency (VLF) receiver for submarine communications utilizing MSK (Minimum Shift Key) modulation/demodulation techniques in hardware.

10.   In the early 2000-2001 timeframe, I designed three GSM multiband mobile phones for a leading telecom equipment manufacturer in Asia.

11.   In the 2002-2007 timeframe, I developed wireless baseband and protocol stack software and assembly code for a leading telecommunications smartphone/handset vendor that focused on efficient realization of speech codecs and echo-cancellation and for another in

2

the optimization of their 3G software stack. My work in this regard included creation of software code, and analysis and revision of existing software code.

12.   I have been extensively involved in the field of electronics systems packaging since the late 1990s, and have been instrumental in proposing the new (then) area of System-on-Package (SOP), and published a key paper in 1999, "*System on Chip or System on Package?*" *in IEEE Design & Test of Computers*, and investigated the role of underfill in electronics packaging along with several other activities in the area of system-on-package (SOP). Further, in 2006, I investigated the design tradeoffs in using a System-on-Chip (SoC) approach versus a System-on-Package approach as outlined in the peer-reviewed paper "*Electronic System, Platform, and Package Codesign*", IEEE Design & Test of Computers, 2006 where I evaluated various options for design and manufacturing of electronics packages for electronics products including smartphones. *See* Figures 6 & 8 reproduced below.
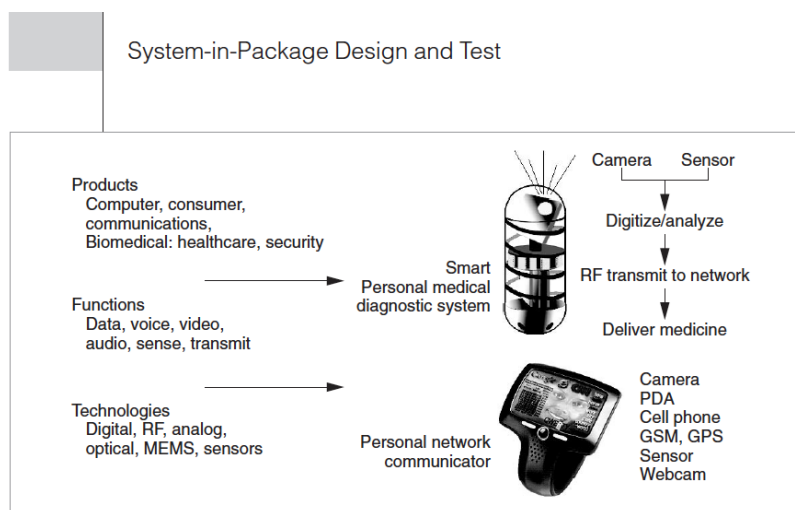

Figure 6. Platform-based miniaturized electronic and bioelectronic systems.
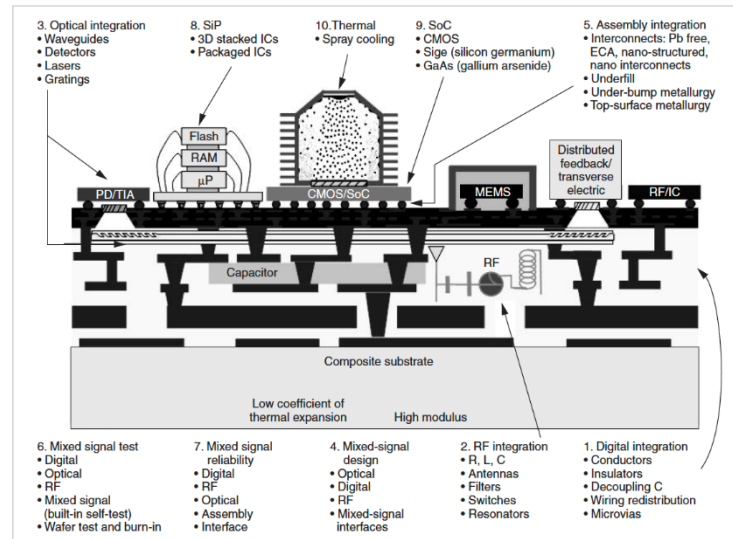
Figure 8. Platform architect's job: building an efficient platform for semiconductor products based on heterogeneous technologies and interdisciplinary design skills.

13. I have also extensively studied the area of robust design and manufacturing optimization through failure and sensitivity analysis, using techniques such as Taguchi design methodologies that provide support to root cause analysis since the early 1990s. I have applied these techniques to various multimedia systems, such as video codecs, including H.263, which has resulted in peer-reviewed publications.

14. I have been an active consultant to industry and various research laboratories (including Massachusetts Institute of Technology Lincoln Labs and Johns Hopkins University Applied Physics Laboratory). My consulting work for MIT Lincoln Labs involved high resolution imaging for defense applications, where I worked in the area of prototyping complex and specialized computing systems. My consulting work for the Johns Hopkins Applied Physics Lab ("APL") mainly involved localization of objects in image fields, where I worked on identifying targets in video and other sensor fields and identifying computer architectures and circuits for power and space-efficient designs.

15. I have founded three companies in the areas of embedded software, military chipsets involving imaging technology, and wireless communications. The first of the companies I founded, VP Technologies, offers products in the area of semiconductor integrated circuits, including building computing systems for imaging systems for avionics

4

electronics for the United States Air Force and the United States Navy, since 1995. I

remain a director of VP Technologies. The second of these companies, Soft Networks,

LLC, offers software for multimedia and wireless computing platforms, including the

development of a set-top box for Intel that decodes MPEG-2 video streams, wireless

protocol stacks, and imaging codecs for multimedia phones. The technology involved

with the design, development, and implementation of the set-top box included parsing the

bit streams, decoding communications protocols, extracting image and video data, and

then processing for subsequent display or storage. The third of these companies, Elastic

Video, uses region of interest-based video encoding or decoding for capturing high

quality video at very low bit rates, with primary application for wireless video systems. I

have also been involved in the design of several smartphones in Asia in the early 2000-

2006 timeframe.

16.   I have authored more than sixty refereed journal publications and around forty peer

reviewed conference publications. I have been active in research in the area of wireless

and mobile communications and some of my recent peer-reviewed publications in this

area include: (i) Mustafa Turkboylari & Vijay K. Madisetti, Effect of Handoff Delay on

the System Performance of TDMA Cellular Systems, Proceedings of the Fourth IEEE

Conference on Mobile and Wireless Communications Network 411-15 (Sept. 9-11,

2002); (ii) Loran A. Jatunov & Vijay K. Madisetti, Computationally-Efficient SNR

Estimation for Bandlimited Wideband CDMA Systems, 5 IEEE Transactions on Wireless

Communications, no. 12 (2006) at 3480-91; and (iii) Nimish Radio, Ying Zhang, Mallik

Tatipamula & Vijay K. Madisetti, Next Generation Applications on Cellular Networks:

Trends, Challenges, and Solutions, 100 Proceedings of the IEEE, no. 4 (April 2012) at

841-54.

17.   I have extensive experience analyzing, designing, and testing systems based on 3GPP

Technical Specifications, including specifications describing WCDMA and HSDPA

technologies. I have been active in the area of location-based services and wireless
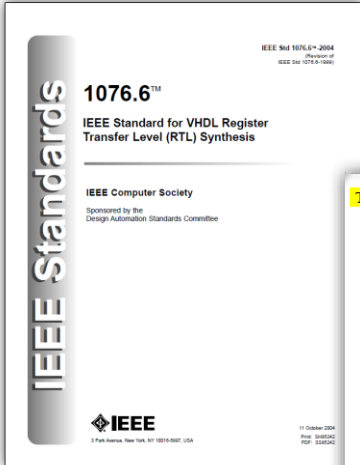
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localization techniques since the mid-1990s and have authored several papers on location-based services, including, Vijay K. Madisetti et al., Mobile Fleet Application Using SOAP and System on Devices (SyD) Middleware Technologies, Communications, Internet, and Information Technology (2002) at 426-31. I have served as associate editor or on the editorial board for technical journals, including IEEE Transactions on Circuits & Systems II, International Journal in Computer Simulation, and International Journal in VLSI Signal Processing.

18.   I have authored or co-authored several books, including VLSI Digital Signal Processors (IEEE Press 1995) and the Digital Signal Processing Handbook (CRC Press, 1998, 2010). I co-authored Quick-Turnaround ASIC Design in VHDL (Kluwer Academic Press 1996) and Platform-Centric Approach to System-on-Chip (SoC) Design (Springer 2004). I am also the editor of several books, including the three-volume DSP Handbook set: Volume 1: Digital Signal Processing Fundamentals, Volume 2: Video, Speech, and Audio Signal Processing and Associated Standards, and Volume 3: Wireless, Networking, Radar, Sensory Array Processing, and Nonlinear Signal Processing, published in 2010 by CRC Press, Boca Raton, Florida. More recently I have authored Cloud Computing (2014, CreateSpace Press), and Internet of Things (2014, CreateSpace), and the book, Cloud Computing, was nominated as a Notable Book of 2014 by the Association of Computing Machinery (ACM) in July 2015.

19.   I have been elected a Fellow of the IEEE, for contributions to embedded computing systems. The Fellow is the highest grade of membership of the IEEE, a world professional body consisting of over 300,000 electrical and electronics engineers, with only one-tenth of one percent (0.1%) of the IEEE membership being elected to the Fellow grade each year. Election to Fellow is based upon votes cast by existing Fellows in IEEE. I have also been awarded the 2006 Frederick Emmons Terman Medal by the American Society of Engineering Education for contributions to Electrical Engineering, including authoring a widely used textbook in the design of VLSI digital signal

processors. I was awarded VHDL International Best Ph.D. Dissertation Advisor Award in 1997 and the NSF RI Award in 1990. I was Technical Program Chair for both the IEEE MASCOTS in 1994 and the IEEE Workshop on Parallel and Distributed Simulation in 1990. In 1989 I was recognized with the Ira Kay IEEE/ACM Best Paper Award for Best Paper presented at the IEEE Annual Simulation Symposium.

20.   I have submitted approximately thirty invention disclosures and provisional patents over the past ten years. I am listed as the inventor on eight issued or allowed U.S. Patents.

21.   I have followed, tested compliance requirements for, participated in, and contributed to activities of Standards Setting Organizations ("SSOs") such as the IEEE, IETF, ETSI, TIA, and others, as part of my work as a teacher and researcher in advanced telecom, wireless and computer technologies since the 1990s.

22.   I have been extensively involved in the activities of one of the premier SSOs in the world, the IEEE, since the 1980s, and I have participated in the development of standards for hardware design and description languages, such as VHDL, used in design of computer chips – IEEE 1076.6. This standard is now used worldwide in design of advanced computer chips and associated design automation tools for VLSI. I have also

taught courses and authored papers and books on how to comply with these standards in terms of writing code for design of chipsets.

23.   The Internet Engineering Task Force (IETF) is the premier SSO in the area of computer networks and associated technologies and creates a number of working groups (WG) that focus on specific deliverables (guidelines, standards specifications, etc.) and focus on creating and improving existing network protocols. I have contributed draft proposals for such improvement to standardized protocols over the past several years that include contributed to mobile wireless, stream-controlled transport protocols, networking, encryption and voice/video transmission. These proposals include:

- IETF Internet Draft (Nov 2002): Enhancements to ECRTP with Applications to Robust Header Compression for Wireless.[1]

- IETF Internet Draft (May 2002): Voice & Video over Mobile IP Networks.[2]

- IETF Internet Draft (July 2002): A Transport Layer Technology for Improving QoS of Networked Multimedia Applications.[3]

24.   I have developed speech and video codecs that comply with 3GPP and ETSI smartphone standards, such as a Wideband AMR and the AMR. These tasks involved developing software to implement the associated 3GPP standards and also tests to verify compliance to these standards. The families of these 3GPP standards include TS 26.071 – TS 26.204, covering over a hundred standard specification documents. The software that I developed that complies with these standards is now available commercial on millions of 3G and 4G handsets worldwide. My codecs were tested on live 3G and 4G networks in Europe and USA since the early 2004 – 2006 timeframe.

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[1] IETF Internet Draft (Nov 2002): Enhancements to ECRTP with Applications to Robust Header Compression for Wireless, URL https://tools.ietf.org/html/draft-madisetti-rao-suresh-rohc-00 (Last Visited on Jan 15, 2019).
[2] IETF Internet Draft (May 2002): Voice & Video over Mobile IP Networks, URL https://tools.ietf.org/html/draft-madisetti-argyriou-voice-video-mip-00 (Last Visited on Jan 15, 2019).
[3] IETF Internet Draft (July 2002): A Transport Layer Technology for Improving QoS of Networked Multimedia Applications, URL https://tools.ietf.org/html/draft-madisetti-argyriou-voice-video-mip-00 (Last Visited on Jan 15, 2019).

25.   I have also developed several speech and VOIP codecs that conform with the ITU (International Telecommunications Union) standards G.723.1, G.729 and Echo Cancellers conforming with the ITU G.168 standards.[4]

26.   The software and code I have developed and tested based on technologies essential to the ITU standards are now used by one of the leading suppliers of VOIP/Internet telephones in the world. This software is also part of commercially released soft switches for internet telephony used extensively in Asia.[5]

27.   As part of earlier litigation-related consulting work, I tested compliance of several smartphones (3G and 4G) in their use of standards-essential patents (SEP) related to 3GPP and 3GPP2 standards, primarily in the area HARQ and encryption. This work involved use of commercial 3GPP test equipment that included base stations and UEs to evaluate compliance to the standard and further opine on the issue of alternatives.

28.   Further, as stated above, I serve as the official representative of Georgia Tech to ETSI. In that role, I manage Georgia Tech's relationship with ETSI and am responsible for representing Georgia Tech's interests as they relate to ETSI, which includes choosing technical areas to which Georgia Tech may contribute, to determine which meetings to attend, and participating in technical work related to various technologies, including those in the area of 5G, 4G, and IoT. Prior to assuming this role, and over the past twenty years, I have been retained to test various commercial mobile and wireless products to determine if they comply with various ETSI, 3GPP, and TIA (including 3GPP2) standards.

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[4] *See* Extensions of Recommendation G.721 adaptive differential pulse code modulation to 24 and 40 kbit/s for digital circuit multiplication equipment application, URL https://www.itu.int/rec/T-REC-G.723/en (Last visited on Jan 15, 2019).

[5] *See* VoIP: BPL Telecom develops integrated platform, URL https://www.thehindubusinessline.com/bline/2002/04/09/stories/2002040900660700.htm (Last visited on Jan 15, 2019).

29.   I am familiar with issues involving standards and electronic design and manufacturing technologies and with determining the meaning of technical terms from the perspective of a "person of ordinary skill in the art" ("POSITA").

30.   I have completed reports, depositions, and provided testimony regarding communications systems in more than 20 proceedings over the past six years. About half of the proceedings in which I have testified were in the area of 2G/3G/4G smartphone design.

B.   **Scope of My Rebuttal Report**

31.   I am a technical expert and will provide a technical analysis based on my experience in the field of electronics systems design and manufacturing. I am not offering any legal opinions. My compensation is not dependent on the outcome of this matter and I am being paid for my time at my usual hourly rate of $550/hour.

32.   I have been asked to review documents produced in this legal matter, all of which are listed in **Appendix B** to my report.

33.   I have been asked to opine whether Google's first-generation Pixel and Pixel XL (hereinafter "Pixel") complied with industry standard processes and procedures during design and manufacture.

34.   I have also been asked to opine whether not ████████████████████████████ was a design or manufacturing defect as per industry standards and technical guidelines.

35.   Finally, I have been asked to review the "Expert Report of S. Nazarian" (Dkt. 94-8) and provide a technical rebuttal to the opinions offered in his report.

36.   The opinions offered in this report are based on my experience as detailed above and in **Appendix A** to my report and the materials considered and relied upon, which are listed in **Appendix B** to my report.

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C.   Summary of My Opinions

37.   Based on the evidence on record, the manufacturing practices used and testing procedures that were followed for the Pixels were acceptable under and compliant with industry standards.

38.   The Pixels complied with all regulatory, quality and reliability tests required by the telecom carriers and complied with the reliability standards set by industry bodies, such as JEDEC.

39.   The alleged Pixel failures during and outside the class period were consistently below failure rates observed for competing smartphones, such as the Apple iPhone.

40.   Dr. Nazarian incorrectly suggests that Google has admitted that ██████████████ ████ contributed to the alleged failure of a small percentage of Pixels.[6] There is no evidence in the record linking ██████████████████████████ nor has Google admitted such a link.

41.   There is also no evidence on record that ████████████████ was a design or manufacturing defect or that ██████████ is "best practice" within the electronics design and manufacturing communities.

42.   There is no industry standard recommendation or practice requiring ███████ in smartphones. Reliable and leading smartphone industry sources show that ███████ may or may not improve reliability. Indeed, many competitors do not use or have not used ██████ in their smartphones.

43.   Dr. Nazarian has not published any peer-reviewed articles or publications in the area of electronics packaging, either with or without focus on reliability ████████.

44.   Dr. Nazarian has done very little work beyond examining Google's documents to provide cursory opinions on them without providing sufficient technical bases for them.

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[6] *See* Nazarian Report at ¶¶ 39-40, 55, and 57.

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45. Dr. Nazarian also has not performed any independent testing to support his conclusions. Dr. Nazarian's work was limited to a visual inspection of just four Pixels to check for the

███████████████

D.   The Design of the Pixels was in Accordance with Industry Standards & Practices

46. Mobile phones sold by carriers within the United States must satisfy a number of requirements and tests before they are marketed to consumers. These involve tests for functionality, conformance to regulations, carrier requirements, etc. I understand the Pixels were primarily sold through Verizon Wireless ("Verizon")[7], which would require several certifications processes and steps to be completed prior to it being offered to their customers. These certifications ensure that products such as the Pixels are designed and manufactured to the quality requirements of networks, carriers, operators and customers.

47. The different types of tests include:

   a.   Government Agencies: The Federal Communications Commission (FCC) requires a series of tests that must be passed to satisfy regulatory conditions for emissions and other features.

   b.   Industry Regulations: The PCS Type Certification Review Board (PTCRB) oversees device certification for member carrier networks.

   c.   Carriers' Testing: The carriers carry out their own testing of the devices.

   d.   Device Manufacturers: The device manufacturers carry out their own series of tests.

   e.   Standards Organizations: The standards organizations (LTE, WiFi, and other related organization) specify compliance tests that must be passed by the devices for compliance.

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[7] Google's Responses to Plaintiffs' Priority Interrogatories, Nos. 7-8 (Approximately 1,006,151 of the 1,450,864 Pixels sold between October 4, 2016 to July 11, 2018 were sold through Verizon).

48.   The PTCRB is the central North American certification organization created and used by

leading 3G and 4G carriers operators (including Verizon) to define and mandate test

specifications to ensure device interoperability on global wireless networks.[8]
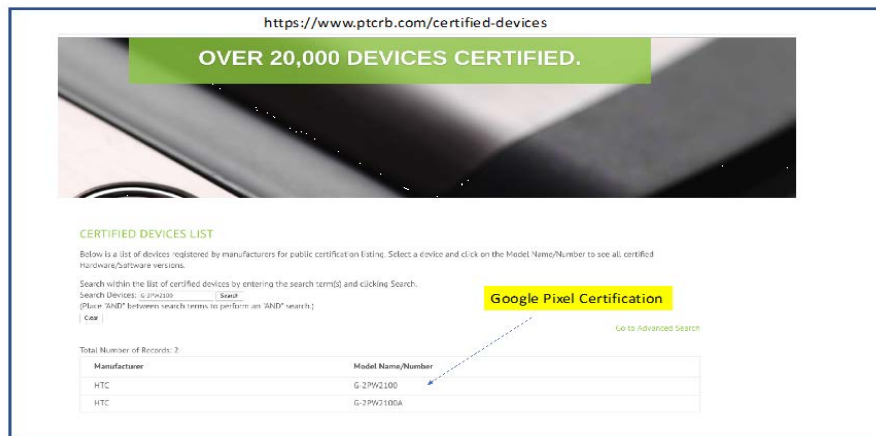
49.   Verizon has its own standards and certification requirements.[9] Verizon's Open Device

Certification Process defines the device conformance and testing requirements that have

to be met prior to use on the Verizon Wireless Network.[10] The testing process includes

requirements for certification and approval by the Federal Communications Commission

(FCC) and also by the Department of Commerce's Bureau of Industry and Security (BIS)

in addition to OD Conformance Testing.[11] Verizon provides a custom Test Campaign for

each device that must be executed and satisfied by each vendor for full compliance with

its standards.[12]

50.   Verizon also tests devices for ruggedness. The following article written in Forbes[13]

confirms that phones sold by Verizon are subjected to thermal and ruggedness testing,

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[8] *See* PCS Type Certification Review Board: PTCRB, URL https://www.ptcrb.com/about/ (Last visited on Jan 15, 2019).

[9]*See* Open Development Device Certification Process, Verizon Wireless, 2017, URL https://opendevelopment.verizonwireless.com/content/dam/opendevelopment/pdf/OpenAccessReq/ODDeviceCertificationProcess.pdf (Last visited on Jan 15, 2019).

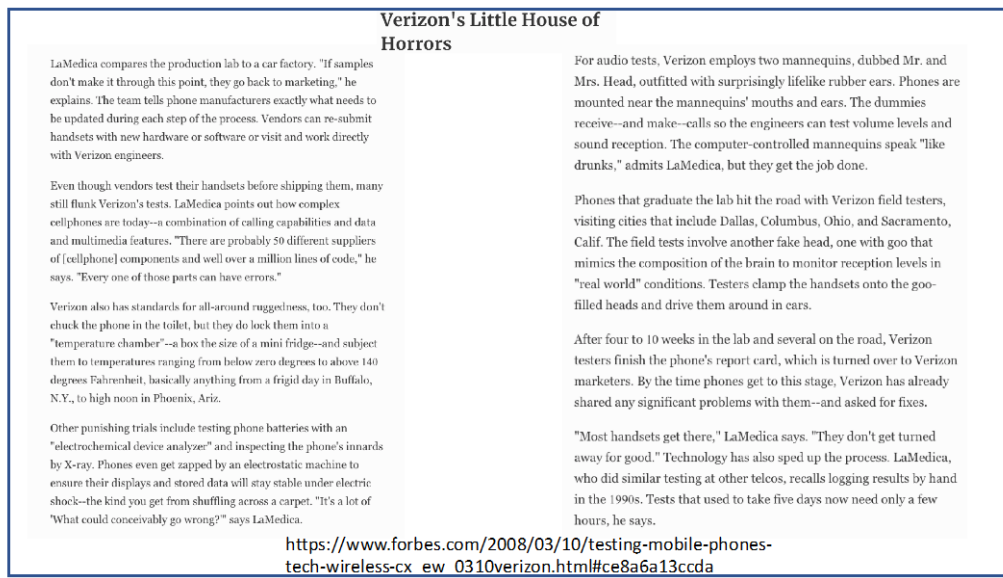[10] *Id.*

[11] *Id.*

[12] *Id.*

[13] *See* Forbes: Verizon Little House of Horrors, March 10, 2008, URL https://www.forbes.com/2008/03/10/testing-mobile-phones-tech-wireless-cx_ew_0310verizon.html#ce8a6a13ccda (Last visited on Jan 15, 2019).

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including *audio tests* over a period of weeks. This is additional confirmation that phones, including Pixels, that are sold through Verizon are subject to rigorous quality and reliability testing for functional and manufacturing flaws, and are sold only after these requirements are satisfied.

Verizon's Little House of Horrors

LaMedica compares the production lab to a car factory. "If samples don't make it through this point, they go back to marketing," he explains. The team tells phone manufacturers exactly what needs to be updated during each step of the process. Vendors can re-submit handsets with new hardware or software or visit and work directly with Verizon engineers.

Even though vendors test their handsets before shipping them, many still flunk Verizon's tests. LaMedica points out how complex cellphones are today--a combination of calling capabilities and data and multimedia features. "There are probably 50 different suppliers of [cellphone] components and well over a million lines of code," he says. "Every one of those parts can have errors."

Verizon also has standards for all-around ruggedness, too. They don't chuck the phone in the toilet, but they do lock them into a "temperature chamber"--a box the size of a mini fridge--and subject them to temperatures ranging from below zero degrees to above 140 degrees Fahrenheit, basically anything from a frigid day in Buffalo, N.Y., to high noon in Phoenix, Ariz.

Other punishing trials include testing phone batteries with an "electrochemical device analyzer" and inspecting the phone's innards by X-ray. Phones even get zapped by an electrostatic machine to ensure their displays and stored data will stay stable under electric shock--the kind you get from shuffling across a carpet. "It's a lot of 'What could conceivably go wrong?'" says LaMedica.

For audio tests, Verizon employs two mannequins, dubbed Mr. and Mrs. Head, outfitted with surprisingly lifelike rubber ears. Phones are mounted near the mannequins' mouths and ears. The dummies receive--and make--calls so the engineers can test volume levels and sound reception. The computer-controlled mannequins speak "like drunks," admits LaMedica, but they get the job done.

Phones that graduate the lab hit the road with Verizon field testers, visiting cities that include Dallas, Columbus, Ohio, and Sacramento, Calif. The field tests involve another fake head, one with goo that mimics the composition of the brain to monitor reception levels in "real world" conditions. Testers clamp the handsets onto the goo-filled heads and drive them around in cars.

After four to 10 weeks in the lab and several on the road, Verizon testers finish the phone's report card, which is turned over to Verizon marketers. By the time phones get to this stage, Verizon has already shared any significant problems with them--and asked for fixes.

"Most handsets get there," LaMedica says. "They don't get turned away for good." Technology has also sped up the process. LaMedica, who did similar testing at other telcos, recalls logging results by hand in the 1990s. Tests that used to take five days now need only a few hours, he says.

https://www.forbes.com/2008/03/10/testing-mobile-phones-tech-wireless-cx_ew_0310verizon.html#ce8a6a13ccda

51.   Verizon also requires vendors and suppliers to stringently test their products before delivering them to Verizon.[14]

52.   The Verizon supplier requirements, for products such as the Pixels, require the supplier to implement a Quality System as per application of industry standard quality standards as noted below for a Quality System:

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[14] *See* Document: Quality Standards, Procedures, and Complaints, Verizon, URL https://www.verizon.com/suppliers/jsp/VerizonQualityStandardsProceduresAndComplaints.pdf (Last visited on Jan 15, 2019).

> **verizon√**
>
> **2   QUALITY SYSTEM** Supplier shall document, implement and maintain a quality control, assurance and improvement system which assures that the System(s), Product(s) and Service(s) provided to Verizon meet all performance standards and requirements, and perform in accordance with Specifications, including, but not limited to those contained in **Attachment A**, entitled "Quality, Reliability and Engineering Specifications," together with the following: TL 9000 Quality Management System Requirements, Handbook (Current Release), and TL 9000 Quality Management System Measurements, Handbook (Current Release) and **Attachment B** entitled, TL 9000 Requirements, Representation and Warranty Language.   Supplier shall be in compliance with all updates or subsequent releases to such performance standards and requirements, including all those listed in this Section or in any attachment hereto, or as currently denominated by the QuEST Forum, Telcordia or Verizon.
>
> If for any reason Supplier is unable to comply with an update or subsequent release to any of the performance standards or requirements noted above within a reasonable timeframe, Supplier shall notify Verizon within thirty (30) days of general availability or notice of updated standard or requirement, and a timeframe shall be mutually agreed upon.
>
> Supplier agrees to allow Verizon or its third party representative to conduct periodic on-site reviews at Supplier's Hardware manufacturing and Software development facility(s) to verify compliance with Specifications. Supplier also agrees to develop corrective action plans for any quality system deficiencies that may be detected during these periodic on-site reviews, and submit such plans to Verizon or its representative within thirty (30) days after the review. Further, Supplier agrees to implement these corrective action plans within six (6) months after the review.

53.   Verizon also requires suppliers of products, such as the Pixels, to provide details of the

delivered product for quality testing as noted below[15]:

> **verizon√**
>
> **3   QUALITY PERFORMANCE REPORTING** Supplier agrees to provide, upon request by Verizon and at no cost to Verizon, data reports which demonstrate the performance of the Supplier's Product while in development, manufacture and service, and the adherence of the Supplier's Product to the Specifications.   Requirements for collecting, calculating and reporting data are defined in documents listed in **Attachment A** hereof-entitled Quality, Reliability And Engineering Specifications.   In addition, Supplier shall evaluate and pursue Capability Maturity Model Integration (CMMI) v1.2 methodology within its Software Engineering processes for quality improvement. Supplier agrees to semi-annual progress reviews with Verizon to review findings and plans to upgrade processes where necessary. Supplier shall evaluate the benefits of using the "staged" approach for progressing through the CMMI levels. Supplier shall also develop a CMMI (Capability Maturity Model Integration) Migration and Implementation Plan within six (6) months of contract execution.   Supplier shall at no cost to Verizon, reach defined CMMI Level 2 maturity within eighteen (18) months of contract execution, and Level 3 maturity within twenty-four (24) months of contract execution.   Supplier shall at no cost to Verizon, maintain continuous improvement by pursuing CMMI Level 4 through Level 5 once previous levels have been achieved.
>
> All requested reports and data shall be delivered to the Verizon contacts set forth in the Notices Section of this Agreement.
>
> Verizon Proprietary and Confidential

54.   Further, Verizon requires suppliers of products, including the Pixels, to provide results of

testing to demonstrate functionality, quality, and reliability as noted below[16]:

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[15] *Id*.

[16] *Id*.

55.   Verizon also requires suppliers, such as those providing the Pixel, to adhere to the

following standards[17]:

56.   I understand that Google satisfied each of Verizon's requirements for suppliers as they

relate to the Pixels. I have reviewed the fully executed "Purchase and Sale Agreement"

No. 820-155886-2016 dated October 2, 2016, between Google and Verizon.[18] As part of

this agreement, ██

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[17] *Id.*

[18] GOOG-WEEKS-00215087 - GOOG-WEEKS-00215166.

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██[19]

57.   In summary, the Pixels were subjected to rigorous quality processes that included

detailed functional and field trial tests as part of Verizon's supplier processes and

agreements prior to being sold to consumers. Only phones that were designed and

manufactured using the best practices available would, in my opinion, be sold by

Verizon.

E.   Pixel and Pixel XL Products Used High Quality CODEC that Complied with Solder Ball Shear Test Standards.

58.   In GOOG-WEEKS-00000117 an image of the ██████████████████████████

████████████████████████████████ is apparently described. The CODEC ████

██████████████████████████

59.   As per the data sheet specification for the ████████████████████████████████

supports high-resolution standards that studios use to master tracks, creating a pure

audiophile listening experience and provides the "most authentic sound reproduction

possible." The ██████████ is thus an excellent design choice for supporting audio

functionality on the Pixels.

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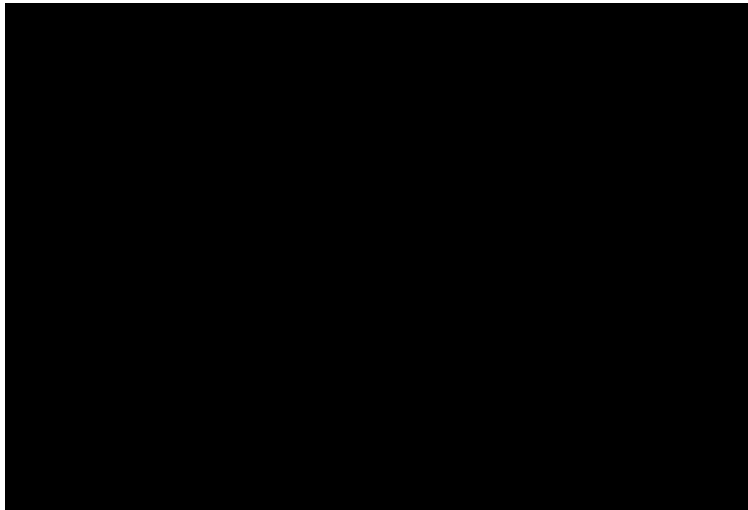
60.   The ████████ uses a wafer-level package with fan-out technology (FOWLP) and allows Qualcomm to offer a very small die footprint, and this ████ is also used in smartphones offered by Samsung (Galaxy S7).[21]

61.   The block diagram of ██████████████████████████████████████ is shown below.[22]
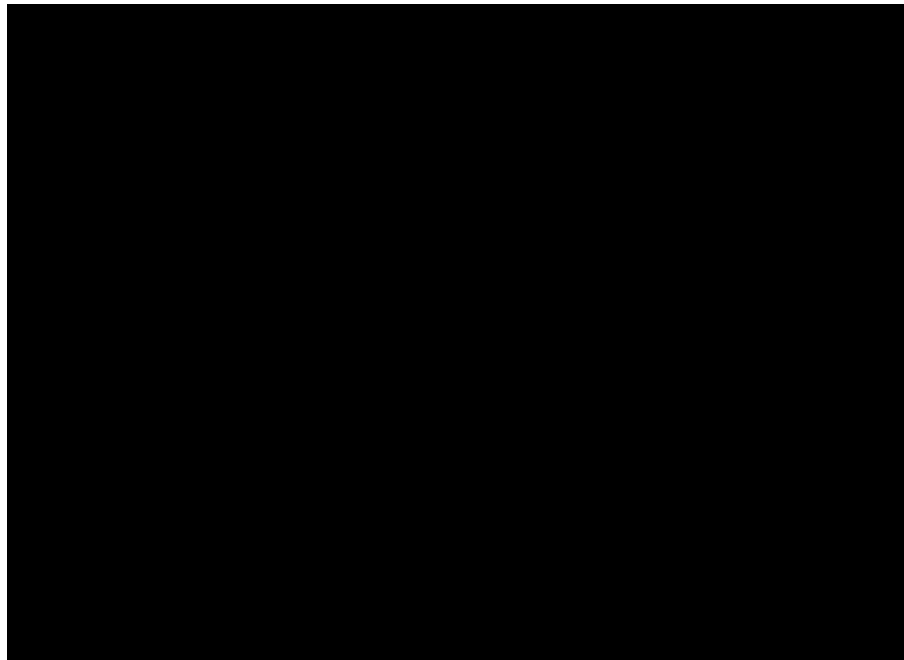
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[21] *See* Qualcomm ████████ Technology and Cost Comparison, ████ ██Last visited on Jan 15, 2019).

[22] *See* Qualcomm Technologies, Inc, ████████████████, Device Specification, LM80-P2751-29 Rev A, ████ ████████████████████████(Last visited on Jan 15, 2019).

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62.   The ███

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63.   The ███

███

███ as described in the JEDEC Standard

ESD22-B117A for ████████████████[24]

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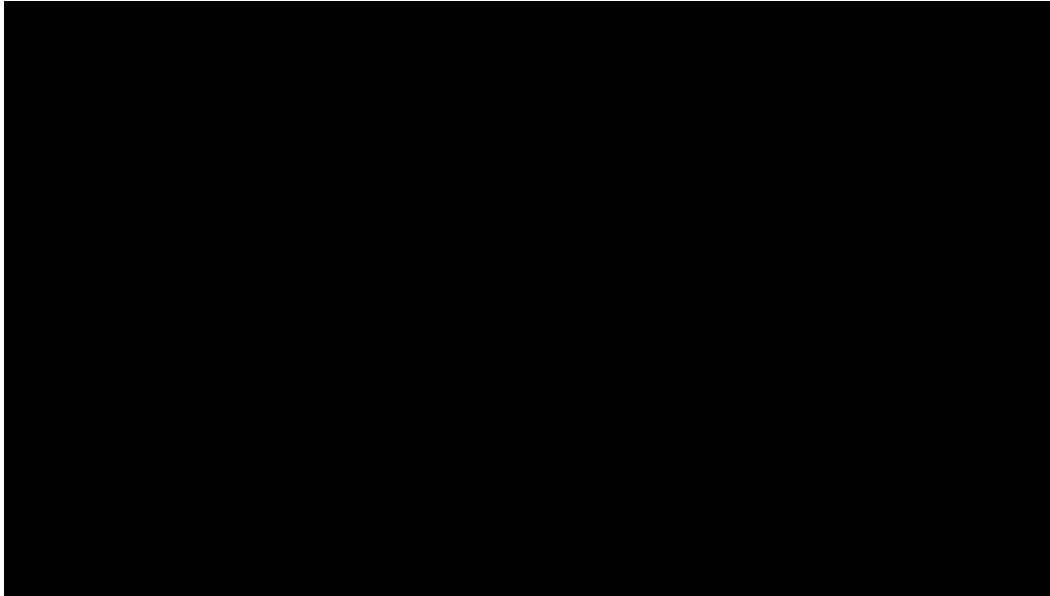
64.   The reliability specifications for ████████   are described in Section 7 of the ████

████ Specification Data Sheet,[25] and Table 7-2 confirms that ███████████████

████ as used in the Pixels *passed* the tests specified in JEDEC JESD22-B117 for ████

██████████ Therefore, the high-quality ██████ in the Pixels passed all manufacturing

requirements of JEDEC ████████████ standards as shown below.

65.   Dr. Nazarian does not appear to contest (and cannot contest) that ████████████ in

the Pixels passed all requirements of industry standard tests for ██████████ prior to

the October 2016 Pixel launch.

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[25]*See* Qualcomm Technologies, Inc, ████████████████, Device Specification, LM80-P2751-29 Rev A., ████
████████████████████████ (Last visited on Jan 15, 2019).

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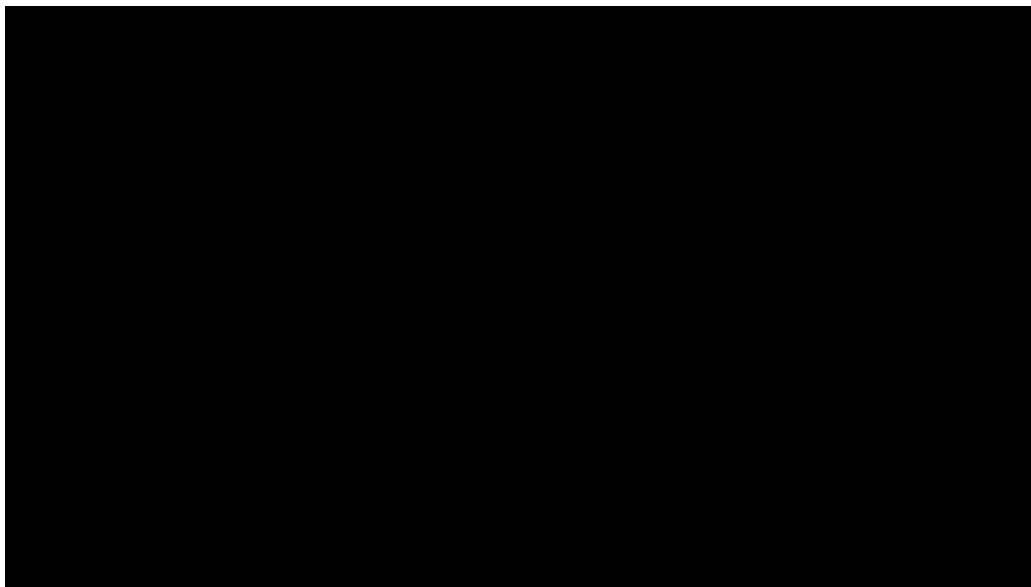
66.   In summary, ██████████████ used in the Pixels satisfied all standardized tests for reliability and suitability for use in electronics products, such as smartphones. This ████ ████ has also been used in smartphones using similar electronics packages by competitors such as Samsung.[26] ██ ██ ████████████[27].

67.   In addition, I have examined the results of extensive pre-release testing of the Pixel phones by HTC as described in HTC QBR (Aug 2016)[28].   Critical reliability tests were completed successfully without critical failures, as shown in the figure below.

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[26]*See* ████████████████ Technology and Cost Comparison, ████ ██ Last visited on Jan 15, 2019).

[27] Declaration of Steven James filed in support of Google's Opposition to Plaintiffs' Motion for Class Certification at ¶ 18.

[28] Google PowerPoint, *HTC QBR*, Aug. 2016 (I understand that the Bates numbers for this document will be provided in Google's forthcoming production).

22
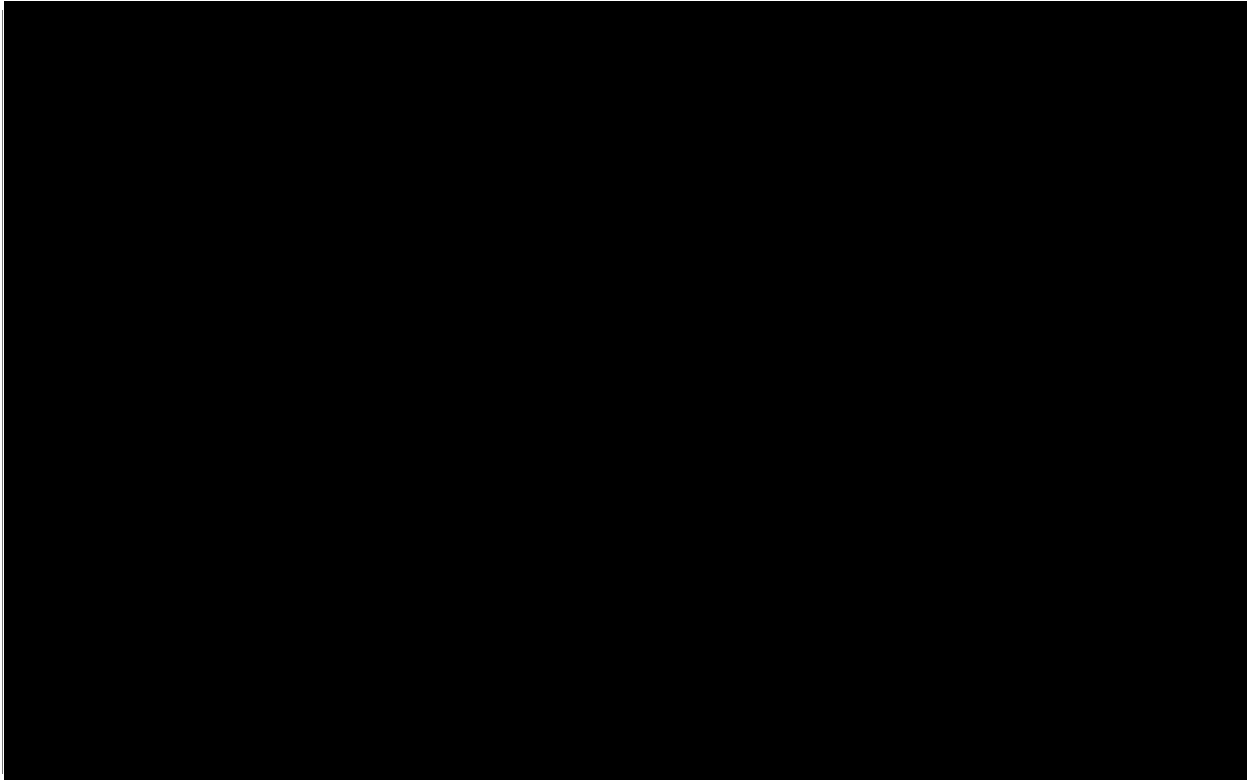
68.   Further, the comprehensive reliability testing included ▮▮▮▮▮▮▮▮▮▮▮▮ ▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮ that were also completed with acceptable results and passed approvals (as shown in the figure below). These test results also confirm that the Pixels passed extensive reliability testing prior to release without any evidence of failures.
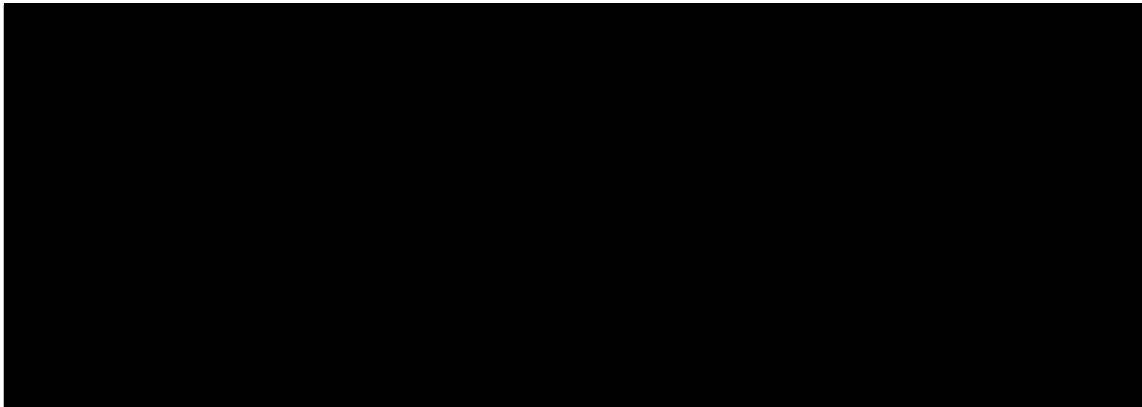
F.   Failure Rates of Pixel are Comparable to Other Phones

69.   SquareTrade publishes several reports on failure rates and reliabilities of smartphones. It published its first report in 2008, and then followed up with another report in 2010. These reports represent the state of failures for smartphones (representative of practically extinct Blackberry and Motorola 3G and early 4G phones) from a period that is nearly ten years earlier from today. Today's smartphones have become more powerful, more complex, and pack more functionality in a smaller form factor (size, weight, area and power). Therefore, it is expected that with more components, more functionality, more complex designs and packaging that the failure rates reported by SquareTrade 2010 report will be smaller than failure rates expected from smartphones today. In other words, the failure rates of smartphones during the time that the Pixels were sold are expected to be greater than those reported by SquareTrade's 2010 report.

70.   SquareTrade[29] published 12-month failure rates for several manufacturers of smartphones, including HTC, the manufacturer of the Pixel. These results are summarized as follows[30]:

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[29] *See* Smart Phone Reliability: Apple iPhones with Fewest Failures, and major Android manufacturers not far behind, URL https://www.squaretrade.com/cell-phone-comparison-study-nov-10 (Last visited on Jan 15, 2019).
[30]*See* Study: iPhone 4 is the most reliable smartphone, but don't drop it, URL https://www.digitaltrends.com/android/study-iphone-4-is-the-most-reliable-smartphone-but-dont-drop-it/ (Last visited on Jan 15, 2019).

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Figure 1. Reported Malfunction Rate

Smart Phone reliability: Apple iPhones with fewest failures, and major Android manufacturers not far behind.
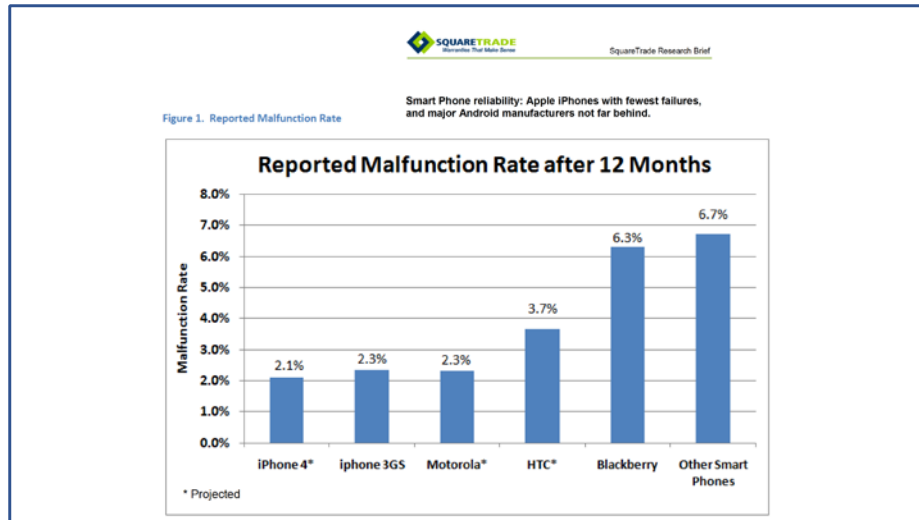
71.   The malfunction rates of smartphones are comparable to other portable electronic products as also noted by the SquareTrade report, and it is interesting to note that despite their complexity smartphones have a smaller failure rate than basic feature phones:

Figure 2 Malfunction rates of common portable electronics
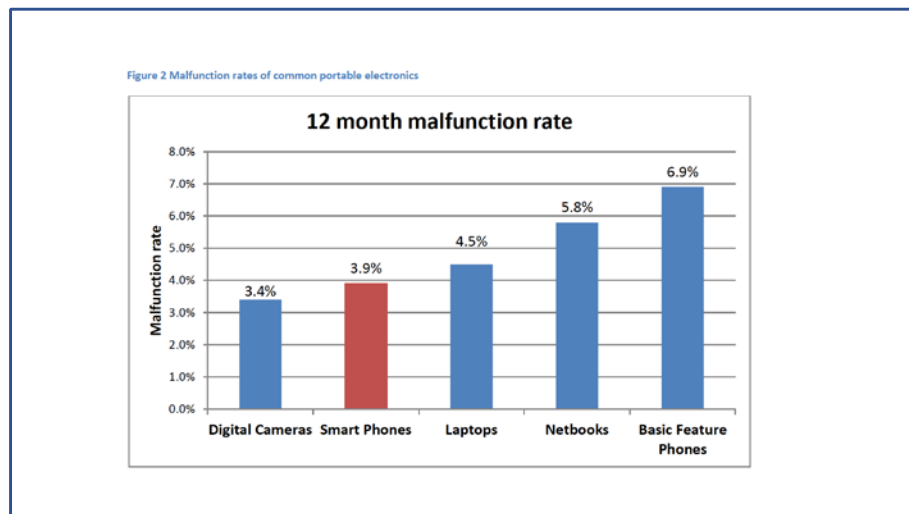
72.   A more recent report on failures of smartphones by Blancco: "*State of Mobile Device Repair & Security*", Q4 2017, February 2018[31], reported the following failure rates for iOS devices (iPhones): 12% in North America, 36% in Europe, and 26% in Asia.

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[31] *See* Trend Report: Q4 2017 – State of Mobile Device Repair & Security, Blancco, URL https://download.blancco.com/download/en-rs-q4-2017-state-of-mobile-device-repair-and-security.pdf (Last visited on Jan 15, 2019).

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73.   In short, the number of alleged audio failures observed in the Pixels is consistent with
        failure rates of other smartphones of similar vintage, features, and functionality. ██
        ██
        ██.[32] ████████████████████████
        ████████████████████████████████████[33] ███████████████████
        ██ which is
        well-below the 12% overall failure rate for iPhones in North America in 2017 as reported
        by Blancco. *See, supra* at ¶ 70. Furthermore, ████████████████████████████
        ██
        ██ (*see*
        GOOG-WEEKS-00011805), ████████████████████████████████████
        ██ all of these
        numbers being *far below* the 12% overall failure rate for iPhones in North America in
        2017 as reported by Blancco. *See id*.

74.   Therefore, Dr. Nazarian's unsupported opinion that the failures rates for the Pixels
        "exceed[] the failure rate that would be tolerable to a reasonable manufacturer of
        smartphone or similar electronic products" is incorrect.[34]

G.   Dr. Nazarian Has Failed to Offer Any Evidence that Shows ████████████████ is
        Evidence of a Design Defect or that ████████████████████████████████ a
        Best Practice for Use in Manufacturing Electronics Products"[35]

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[32] Declaration of Steven James filed in support of Google's Opposition to Plaintiffs' Motion for Class Certification at ¶¶ 16, 17; *see also* Google's Responses to Plaintiffs' Priority Interrogatories, No. 3.
[33] *Id*.
[34] Nazarian Report at ¶ 29.
[35] Nazarian Report at ¶ 25.

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75.   In conducting its analysis to determine the root cause of the ███████████████████

███████████ in the Pixels, Google found that the ███████████████████

███

███████████████████████████ ██[6] Google did not directly attribute any audio

failures to ███████████ but instead identified a ███████████████████

███████████ audio failures of package-on-package electronic products, such as mobile

phones.[37]

76.   In my opinion, it is both inappropriate and incorrect for Dr. Nazarian to attribute any

Pixel audio failures to ███████████ in isolation.[38] Indeed, Dr. Nazarian testified that he

did not perform any tests on the Pixels he examined, nor did he test for any of the other

potential ███████████████████████ identified by Google in its root cause

analysis.[39] Dr. Nazarian also failed to cite to any industry standards that prescribe ███████

███████ for electronics products, nor could he provide information as to whether

Apple or Samsung utilized underfill in their smartphones.[40]

77.   The Pixels used ██████ that complied with industry regulations for reliability to

demonstrate the ███

███[41]

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[36] GOOG-WEEKS-00000114-119 (Google's "DTAG Audio Failure Analysis and Corrective Action Report" from May 22, 2017) at GOOG-WEEKS-00000115.

[37] GOOG-WEEKS-000000122 (Ex 3 to James Deposition).

[38] Nazarian Deposition at 58:1-7.

[39] Nazarian Deposition at 74:1-20; GOOG-WEEKS-00000115.

[40] Nazarian Deposition at 80:4-81:4 (admitting he does not know whether Apple or any smartphone devices manufactured between 2015 and the present ███████████████████████); *see also id*. at 69:20-70:3 (admitting he does not know if Apple or Samsung met the JEDEC standards for ███████ for devices sold between 2015 and 2018).

[41] *See, supra* at ¶¶ 58-64 (███████ Audio Codec discussion).

TEST METHOD B117: ███████████████

(From JEDEC Board Ballot, JCB-06-37, formulated under the cognizance of the JC-14.1 Subcommittee on Reliability Test Methods for Packaged Devices.)

1   Scope

This test method applies ███████████ force testing prior to end-use attachment. ████████ are sheared individually; force and failure mode data are collected and analyzed. Both low and high speed testing are covered by this document.

The purpose of this test is conducted to assess the ability of ██████████████████████ forces that may be applied during device manufacturing, handling, test, shipment and end-use conditions. ████████████ s a destructive test.

78.   Google describes its ██

██████████████████████████████.[42]

79.   Dr. Nazarian has not provided any analysis of the ████████████████████████████

████████████████████████████████.[43] Dr. Nazarian's

unsupported opinion that the ████████████████████ is problematic because, as will

be explained in more detail below, certain ████████████ may reduce reliability of the

package-on-package electronic product it is applied to, and there is no consistent industry

standard as to whether or not ████████████████████.[44]

80.   Google's root cause analysis identifies possible causes of ████████████████

██

██████████████████████████████.[45]

[42] GOOG-WEEKS-00000116; GOOG-WEEKS-00000122.
[43] *See* Nazarian Deposition at 51:1-12.
[44] *See* K. Dhandapani, et al, "Improving Solder Joint Reliability for PoP Packages in Current Mobile Ecosystem", 2018 IEEE 68th Electronic Components and Technology Conference ("Qualcomm 2018 Paper").
[45] GOOG-WEEKS-00000116; GOOG-WEEKS-00000122.

81.   There is no evidence in the record that ███████████████████████████

███ nor has

Google confirmed this link.[46]

82.   As discussed, Dr. Nazarian has not performed an independent analysis to determine the

root cause of ██

██

████████████████

83.   Dr. Nazarian admits that the relevant components for the first-generation Pixels and Pixel

XLs are substantially similar, but he is unable to explain why ████████████████

██

████████████████████████ .[47] Dr. Nazarian also admits that heat, force and

intense vibration can █████████████████ .[48]

84.   Because there is no evidence that a firm ████████████████████████

████████████████ any options for "fixing" the alleged problems were done, in

my opinion, from an abundance of caution and not because there was a mistake detected

in the way the Pixels were designed or manufactured. To the contrary, the Pixels were

manufactured using processes consistently used by other smartphone manufacturers,

utilizing industry standards (including standards for failure and reliability in presence of

thermal and mechanical shock), and in full compliance with telecom carriers'

conformance and testing requirements.[49]

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[46] *See* James Deposition at 142, 145, 164, 165; Declaration of Steven James filed in support of Google's Opposition
to Plaintiffs' Motion for Class Certification at ¶¶ 11, 12.
[47] *See* Nazarian Deposition at 106:12-23, 107:15-21.
[48] Nazarian Deposition at 110:13-22; *see also* GOOG-WEEKS-00000122.
[49]*See* Verizon: Quality Standards, Procedures, and Complaints, Verizon, URL
https://www.verizon.com/suppliers/jsp/VerizonQualityStandardsProceduresAndComplaints.pdf (Last visited on Jan
15, 2019).

85.   The ██████████████ has been used in several smartphones from competitors, including Samsung, and has passed through the JEDEC ██████████ standard tests.[50]

86.   Further, there is a lack of industry standard practice as to whether ██████ may or may not improve reliability.[51] This, in my opinion, further undermines Dr. Nazarian's unsupported thesis that the ███ ████████████████████████████████████.[52]

87.   The only work performed by Dr. Nazarian that he relies on to support his conclusions about the █████████████████████ in the Pixels is limited to a visual inspection of four Pixels to determine whether ███████████████████████[53] This work is of no value, given the clear disclosure from Google that ██████████████████ ███ ██████████████████████[54]

88.   Dr. Nazarian also confirmed in his deposition that the use of package-on-package electronic assembly techniques used for smartphones is consistent with industry practice.[55] Notably, the literature that he himself cites to support this indicates that the

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[50]*See* Qualcomm Technologies, Inc, ██████████████, Device Specification, LM80-P2751-29 Rev A., ██████ ███████████████████████ Last visited on Jan 15, 2019).

[51] *See, e.g.*, S. Y. Jang, et al, "Wafer Level Package Solder Joint Reliability Study for Portable Electronic Devices", Proceedings of Electronics Components & Technology Conference, July 2005 ("Samsung Paper"); P. T. Vianco, et al, "Predicting the Reliability of Package-on-Package Interconnections Using Computational Modeling", SMTA Journal, Volume 27, Issue 1, 2014 ("Sandia National Labs Paper"); and Qualcomm's own reliability tests with and without underfill (UF) in package-on-package products in K. Dhandapani, et al, "Improving Solder Joint Reliability for PoP Packages in Current Mobile Ecosystem", 2018 IEEE 68th Electronic Components and Technology Conference ("Qualcomm 2018 Paper").

[52] Nazarian Deposition at 50:1-12; K. Dhandapani, et al, "Improving Solder Joint Reliability for PoP Packages in Current Mobile Ecosystem", 2018 IEEE 68th Electronic Components and Technology Conference ("Qualcomm 2018 Paper"); S. Y. Jang, et al, "Wafer Level Package Solder Joint Reliability Study for Portable Electronic Devices", Proceedings of Electronics Components & Technology Conference, July 2005 ("Samsung Paper"); P. T. Vianco, et al, "Predicting the Reliability of Package-on-Package Interconnections Using Computational Modeling", SMTA Journal, Volume 27, Issue 1, 2014 ("Sandia National Labs Paper").

[53] *See* Nazarian Report at ¶¶ 41-57.

[54] *See* GOOG-WEEKS-00000121.

[55] *See* Nazarian Deposition at 61:1-20.

use of certain types of ███████ may adversely affect reliability.[56] I am of the same opinion based on my experience in this area and also based on studies in the peer-reviewed articles that I cite, including the Qualcomm 2018 Paper, Sandia National Labs Paper and the Samsung Paper.[57]

H. Dr. Nazarian Did Not Conduct Any Independent Testing to Support His Conclusions

89.   The JEDEC standard JESD22-B111[58], Board Level Drop Test Method of Components for Handheld Electronic Products, has been developed and widely used for board-level drop testing of handheld electronics products, including smartphones.[59]

90.   For testing shear bearing capacity of solder ball joints, the industry has developed and widely used the JEDEC standard JESD22-B117A, Solder Ball Shear, to guide its characterization of electronics products reliability in context of solder ball to pad joint failures.[60]

91.   For thermal cycle testing, the JEDEC JESD22-A106B[61] thermal shock standard is also used. These tests cover all area arrays and perimeter-leaded surface-mounted devices

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[56] *See* Nazarian Deposition at 62:15-25, 63:1-21; *see also* Exhibit 55 to Nazarian Deposition (Craig Hillman & Randy Kong, *Quality and Reliability Challenges for Package-on-Package*, DfR Solutions, http://www.dfrsolutions.com/hubfs/DfR_Solutions_Website/Resources-Archived/White-Papers/Reliability/Quality-and-Reliability-Challenges-for-Package-on-Package.pdf).

[57] *See* K. Dhandapani, et al, "Improving Solder Joint Reliability for PoP Packages in Current Mobile Ecosystem", 2018 IEEE 68th Electronic Components and Technology Conference ("Qualcomm 2018 Paper"); S. Y. Jang, et al, "Wafer Level Package Solder Joint Reliability Study for Portable Electronic Devices", Proceedings of Electronics Components & Technology Conference, July 2005 ("Samsung Paper"); P. T. Vianco, et al, "Predicting the Reliability of Package-on-Package Interconnections Using Computational Modeling", SMTA Journal, Volume 27, Issue 1, 2014 ("Sandia National Labs Paper").

[58] *See* JEDEC: Board Level Drop Test Method of Components for Handheld Electronic Products, URL https://www.jedec.org/standards-documents/docs/jesd-22-b111 (Last visited on Jan 15, 2019).

[59] *See* K. Dhandapani, et al, "Improving Solder Joint Reliability for PoP Packages in Current Mobile Ecosystem", 2018 IEEE 68th Electronic Components and Technology Conference ("Qualcomm 2018 Paper").

[60] *See* JEDEC Standard ESD22-B117A, Solder Ball Shear, JESD22-B117A, October 2006, URL https://www.jedec.org/sites/default/files/docs/22b117A.pdf (Last visited on Jan 15, 2019).

[61] *See* JEDEC: Thermal Shock, URL https://www.jedec.org/standards-documents/docs/jesd-22-a106b (Last visited on Jan 15, 2019).

such as BGAs, LGAs, CSPs, TSOPs, and QFN's typically used in hand-held electronics products.[62]

92.   Dr. Nazarian has not performed any tests nor has he performed any independent analyses of the results of any tests performed on the accused Pixel phones for thermal and/or drop conditions as specified in JEDEC industry standards.[63]

93.   Typical tests, when performed to industry level standards, would require advanced SEM electron microscopy instrumentation and many months (if not years) of time to complete, and has been undertaken only by very large industry entities or organizations, and any isolated visual inspection-based tests that Dr. Nazarian may perform to indicate the ████████████████████████████ would not be consistent with industry practice.[64]   While some of the references cited in Exhibit B to Dr. Nazarian's Report (Dkt. 94-8) may refer to these tests, Dr. Nazarian has not been able to cite to these to support his opinions or conclusions because he did not perform any of them. Furthermore, with a design cycle time of less than 2 years per smartphone model, no manufacturer would be able to complete detailed testing in a manner that would eliminate all failures within a smartphone.

94.   In summary, Dr. Nazarian has not independently conducted any tests to reliably show or support his alleged conclusion that ████████████████████████████████████ nor is there any such ████████████████████████████████ is a "best practice" approach to smartphone manufacturing.[65]

I.   There is No Standardized or Uniform Recommendation Nor is there a "[B]est [P]ractice" on ████████████████ Within Industry and Professional Organizations

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[62] *Id.*
[63] *See* Nazarian Deposition at 65:11-25, 74:5-11.
[64] K. Dhandapani, et al, "Improving Solder Joint Reliability for PoP Packages in Current Mobile Ecosystem", 2018 IEEE 68th Electronic Components and Technology Conference ("Qualcomm 2018 Paper").
[65] *See* Nazarian Report at ¶25.

95.   While ▇▇▇▇▇ may improve reliability under certain conditions, it may also decrease

reliability under other conditions.[66] In the area of mobile products, that include the Pixel,

there is no prescribed recommendation or standardized approach to ▇▇▇▇▇▇▇ in

products.[67] ▇▇▇▇▇ may or may not improve reliability, and several factors including

but not ▇▇▇▇▇▇▇▇▇▇▇▇▇▇▇▇▇▇▇▇▇▇▇▇▇▇▇▇▇▇▇▇▇▇▇▇▇▇

▇▇▇

▇▇▇▇▇ must also be considered[68]. The following studies provide additional support

for these opinions:

   a.   P. T. Vianco, et al, "Predicting the Reliability of Package-on-Package

         Interconnections Using Computational Modeling", *SMTA Journal, Volume 27,*

         Issue 1, 2014 ("Sandia National Labs Paper");

   b.   K. Dhandapani, et al, "Improving Solder Joint Reliability for PoP Packages in

         Current Mobile Ecosystem", *2018 IEEE 68th Electronic Components and*

         Technology Conference. ("Qualcomm 2018 Paper");

   c.   S. Y. Jang, et al, "Wafer Level Package Solder Joint Reliability Study for Portable

         Electronic Devices", *Proceedings of Electronics Components & Technology*

         Conference, July 2005. ("Samsung Paper"); and

   d.   Nvidia Article on failures due to use of underfill: "Why Nvidia's Chips are

         Defective." [69]

96.   Even Dr. Nazarian admits that "improper selection and ▇▇▇▇▇▇▇ may greatly

reduce reliability under temperature cycling."[70]

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[66] *See* K. Dhandapani, et al, "Improving Solder Joint Reliability for PoP Packages in Current Mobile Ecosystem",
2018 IEEE 68th Electronic Components and Technology Conference ("Qualcomm 2018 Paper"); P. T. Vianco, et al,
"Predicting the Reliability of Package-on-Package Interconnections Using Computational Modeling", SMTA
Journal, Volume 27, Issue 1, 2014 ("Sandia National Labs Paper").
[67] *See id*.
[68] *See id*.
[69] Report: Why Nvidia's Chips are Defective, 2010, URL https://www.semiaccurate.com/2010/07/11/why-nvidias-chips-are-defective/ (Last visited on Jan 15, 2019).
[70] *See* Nazarian Deposition at 68:12-20.

97.   There appears to be an implicit circumstantial assumption made by Dr. Nazarian that

because there seem to be ███

██

██████████████████████████████████████ [71]   This is incorrect. If a child goes to

school and catches a cold for some reason, and the child is asked to wear a spacesuit the

next time she goes to school and, therefore, does not catch a cold, it is unreasonable to

conclude that every child should have worn a space suit in the first place.

98.   Therefore, in my opinion, Dr. Nazarian's conclusion that ███████████████████

███ [72] is

incorrect, because there is no clear consensus as to its benefits or disadvantages, nor is

there is standard requiring ████████████ in electronics products, such as smartphones,

provided by the industry and research communities.

99.   My work in this matter is ongoing and my opinions will continue to be informed by any

additional material that becomes available to me. I reserve the right to update or modify

the opinions expressed above if additional information becomes available to me.

        I declare under the penalty of perjury that the foregoing is true and correct to the best of

my knowledge. Signed on this 23rd day of January, 2019 in Atlanta, Georgia.

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   Vijay K. Madisetti, Phd. 1/23/2019

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[71] *See* Nazarian Report at ¶¶ 29 and 57.
[72] Nazarian Report at ¶ 25.

Appendix A

Qualifications & Past Testimony

Dr. Vijay K. Madisetti
Fellow, IEEE
vkm@madisetti.com
Cell: 770-527-0177
Address:
56 Creekside Park Drive
Johns Creek, GA 30022

Employment:

- 1984-1989: Post Graduate Researcher (UC Berkeley),
- 1989-present: Full Professor of Electrical & Computer Engineering (**Georgia Tech, Atlanta, GA 30332**).

Areas of Technical Interest –   Wireless & Mobile Communications, Computer Engineering, Circuit Design (Analog/Digital), Software Engineering, Electronics Packaging, Digital Signal Processing, Wireline & Wireless Computer Networks, Software Systems**,** Control Systems, Cloud Computing.

Startup Companies:

Director, **VP Technologies, Inc**. (1995-): A startup commercialized through Georgia Tech's Advanced Technology Development Corporation (ATDC) focusing on digital software and hardware design services for military market. http://www.vptinc.com

Director, **Soft Networks, LLC** (2001-2007): A startup commercialized through Georgia Tech support focusing on software development tools and compilers for Cellular/WiFi/VOIP/telecommunication products. http://www.soft-networks.com

Director, **Elastic Video Inc.** (2007- 2009): A startup commercialized through Georgia Tech's VentureLab (http://venturelab.gatech.edu) development image and video processing software for wireless & IP networking.

1

Professor Vijay K. Madisetti, ECE

Litigation Experience (2011-2018) With Testimony
(Note: There may be multiple cases between the parties, e.g., District Court v. ITC, US versus Foreign Cases)

Case Name: HTC v. IPCOM
Case No: 1:2008-cv-01897 (District of Columbia)
Expert for IPCOM
(3G Standards: 2009 – 2012)
Testified by deposition

Case Name: Apple v. Kodak
Case No. ITC 337-TA-717 (ITC)
Expert for Kodak
(Digital Image Processing & UI: 2008-2011)
Testified at trial

Case Name: Harkabi v. Sandisk,
Case No: 1:08-cv-08203-WHP (SDNY)
Expert for Harkabi
(Digital Rights Management for Flash Devices: 2010-2012)
Testified at trial

Case Name: Yangaroo Inc. v. Destiny Media Technologies, Inc.
Case No: 09-C-0462 (ED Wisconsin)
Expert for Yangaroo.
(Digital Rights Management Streaming: 2010-2011)
Testified by deposition

Case Name: Motorola v. Microsoft,
Case No: ITC 337-TA-752
Expert for Motorola
(Peer to Peer Gaming: 2011-2013)
Testified at trial

Case Name: Motorola v. Apple,
Case No: ITC 337-TA-745 (ITC)
Expert for Motorola
(Mobile Applications & UI: 2011-2012)
Testified at trial

Case Name: Innovative Sonic Ltd. vs. RIM
Case No: 3:11-cv-00706-K-BF (ND Dallas)
Expert for Innovative Sonic Ltd
(3G Standards – Encryption, HSDPA: 2010-2013)
Testified at trial

Professor Vijay K. Madisetti, ECE

Case Name: Interdigital v. ZTE et al (JDA)
Case No: ITC 337-TA-800
Expert for JDA
(3G Standards – HSDPA: 2012-2013)
Testified at trial

Case Name: Kodak v. Apple, HTC
Case No: ITC 337-TA-831
Expert for Kodak
(Digital Image Processing & UIs: 2011-2012)
Submitted reports

Case Name: Calypso v. T-Mobile
Case No: 2:08-CV-441-JRG-RSP [ED Texas]
Expert for T-Mobile
(Unified Communications: 2012-2013)
Testified by deposition

Case Name: TracBeam v. AT&T
Case No: 6:11-cv-00096-LED [ED Texas]
Expert for AT&T
(GPS Services: 2011-2012)
Testified by deposition

Case Name: BT v. Cox/Comcast
Case No: 10-658 (SLR) (District of Delaware)
Expert for Cox and Comcast
(VOIP, Network Management: 2012-2014)
Testified by deposition

Case Name: Ericsson v. Samsung
Case No: 337-TA-862 (ITC)
Expert for Ericsson
(RF Receivers, EDGE Standards: 2012- 2013)
Testified at trial

Case Name: IPR – ContentGuard v. ZTE
Case No: (PTAB)
Expert for ZTE
(DRM for Digital Devices: 2012-2014)
Testified by deposition

3

Professor Vijay K. Madisetti, ECE

Case Name: Emblaze v. Apple
Case No: 5:11-cv-01079-PSG (ND Cal)
Expert for Emblaze
(Digital Video/Audio Streaming: 2012-2014)
Testified at trial

Case Name: Emblaze v. Microsoft
Case No: 3:12-cv-05422-JST (ND Cal)
Expert for Emblaze
(Digital Video/Audio Streaming: 2012 - Present)
Ongoing

Case Name: MMI v. RIM
Case No: 2:10-cv-00113-TJW-CE (ED Texas)
Expert for MMI
(Area: Mobile Devices/User Interfaces: 2012- 2013)
Testified by deposition

Case Name: Wi-LAN v. Apple
Case No: 13-cv-0790 DMS (ED Texas)
Case No: 3:14-cv-010507-DMS-BLM
Expert for Wi-LAN
(Area: 4G/3G Wireless Communications: 2013 –2018)
Testified by Deposition

Case Name: Sentius LLC v. Microsoft
Case No: 5:13-cv-00825-PSG (ND Cal)
Expert for Sentius
(Area: Enterprise Software Systems: 2014-2015)
Testified by deposition

Case Name: Medius Eagle Harbor v. Ford
Case No: 3:1-cv-05503-BHS (WD Washington)
Expert for Medius Tech
(Area: Automotive Multimedia Systems: 2014-2016)
Testified at Trial

Genband US LLC v. Metaswitch Networks
No 2:14-cv-33 (E.D. Texas)
Expert for Metaswitch Networks
Technology: Voice & Data Over IP Networks (2014-2015)
Submitted declarations & deposition

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Enterprise - Systems Technologies S.a.r.l v. Samsung Electronics Co. Ltd
Case No: 6:14-cv-555-MHS (ED Texas) and ITC Inv. No. 337-TA-925
Expert for Samsung
Technology: Android Operating System (2014-2015)
Testified by deposition

Ericsson Inc. v. Apple Inc.
Case No: 2:15-cv-287 (ED Texas) and ITC-337-952/953
Expert for Ericsson
Technology: 4G Wireless Systems (2015 – present)
Testified by deposition & Trial

Intellectual Ventures LLC v. Motorola Mobility LLC (Google)
Case No: 13-cv-61358-RST (S.D. Florida)
Expert for Google
Technology: Wireless Systems (2013- present)
Testified by deposition (IPR)

Intellectual Ventures LLC v. Nikon Corp
C.A No. 11-1025-SLR (District of Delaware)
Expert for Nikon
Technology: Wireless Systems (WiFi) (2014-2015)
Submitted declarations

Masimo v. Mindray Biomedical Electronics Co. / Philips
Case No: SACV-12-02206 CJC (JPRx) (C.D. California)
8:12-cv-02206-CJC-JPR
Expert for Masimo
Technology: Pulse Oximetry (2014 – 2016)
Submitted reports, testified by deposition

Samsung v. Nvidia
Case No: 3:14-cv-757-REP ED Virginia
Expert for Samsung
Technology: Microprocessors & Memories (2014 – 2016)
Submitted reports & Deposition & Trial

Chrimar v. HP/Cisco/Alcatel/Dell/Adtran/AeroHive/D-Link/TP-Link/TrendNet/Juniper Networks/CoStar/Accton/AMX
Case No: 4:13-cv-1300-JSW, Case 6:15-cv-163 (ED Texas)
Case No: 6:15-cv-00618-JRG-JDL (ED Texas)
Expert for Chrimar
Technology: Power over Ethernet (2015-2017)
Submitted reports & Deposition & Trial

Professor Vijay K. Madisetti, ECE

Chamberlain v. Ryobi/TTI
Case No: 1:16-cv-06097 (ND Illinois)
Expert for Ryobi
Technology: Wireless/IoT/Barrier Movement (2016 – present)
Submitted reports & deposition & trial testimony

IOEngine v. IMC/Imation
Case No: cv-14-1572-GMS (US Delaware)
Expert for IMC/Imation
Technology: Networked Storage Device (2016-2017)
Submitted reports & deposition & trial testimony

Huawei v. Samsung
Case No: 3:16-cv-2787-WHO (ND Cal)
Expert for Samsung
Technology: 4G/LTE Random Access Protocols (2016-present)
Submitted reports & deposition

Hitachi Maxell v. ZTE/Huawei
Case No: 5:16-cv-00178-RWS (ED Texas)
Expert for Hitachi Maxell
Technology: Digital Cameras
Submitted reports & deposition (2017 – present)

Qualcomm v. Apple
Case No: 17-ccv-0108-GPC-MDD (SD Cal) Also, Related ITC/FTC Matters
Expert for Qualcomm
Technology: 4G/Wireless Communications/Smartphones (2017-present)
Submitted Reports and Deposition

Qualcomm v. Apple
Case No: 3:17-cv-01375-DMS-MDD (SD Cal)
Expert for Qualcomm
Technology: 4G/Wireless Communications/Smartphones (2017-present)
Submitted Reports and Deposition

Optis v. Huawei
Case No: 2:17-cv-123 (E.D. Texas)
Expert for Optis Wireless
Technology: 4G/Video (2017-present)
Submitted reports & deposition

Professor Vijay K. Madisetti, ECE

Broadcom v. Sony
Case No: 8:16-cv-1052 (PTAB and Central Cal)
Expert for Broadcom
Technology: Wi Fi
No activity - settled (2017 – 2017)

Ameranth v. Hyatt Corporation
Case No: 3:11-cv-1810 (SD Cal)
Expert for Hyatt
Technology: Wireless eCommerce Applications (2017-present)
Expert Technical consulting

Rovi v. Comcast
ITC No. 337-TA-1103 (ITC)
Expert for Rovi
Technology: Digital Video & interactive GUI (2018-present)
Reports and Deposition

Beckman Coulter v. Sysmex
Case No: 1:17-cv-24049-DPG (ND Illinois)
Expert for Sysmex
Technology: Medical Instrumentation Automation (2017-present)
Testifying Expert

TQ Delta
Expert for TQ Delta
Technology: DSL Technologies (2018-present)
Testifying Expert

Additional matters include declarations supporting IPRs at the PTAB for Google (US Patent 8,601,154), On Semiconductor (US Patent 6,212,079), Ubisoft (US Patent 5,490,216), Broadcom (WiFi), Sony (US Patent 6,101,534), Kia, (US Patent 5,530,431), Qualcomm, Fortinet (US patent 6,195,587), and ZTE (US Patent 7,523,072), and Ericsson, Amazon, Ring, Digital Ally, BMC Software.

Earned Degrees

1. **B. Tech (Hons), Electronics & Electrical Comm. Engineering**
   *Indian Institute of Technology (IIT), Kharagpur, India*
   1984.

2. **Ph.D., Electrical Engineering & Computer Sciences (EECS)**
   University of California (UC), Berkeley. CA
   1989.

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Books

1. **VLSI Digital Signal Processors**
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   Boston: MA, IEEE Press: Butterworth Heinemann, 1995, 525 pp.

2. **Quick-Turnaround ASIC Design in VHDL**
   Romdhane, M., Madisetti, V.K., Hines, J.
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3. **The Digital Signal Processing Handbook (First Edition)**
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   Madisetti, V. K. (Editor)
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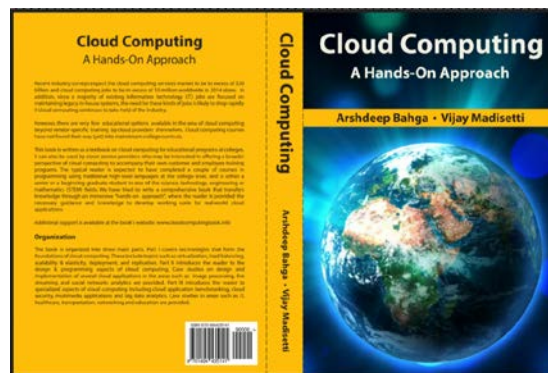
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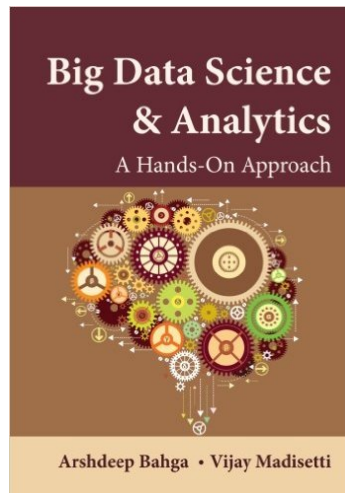
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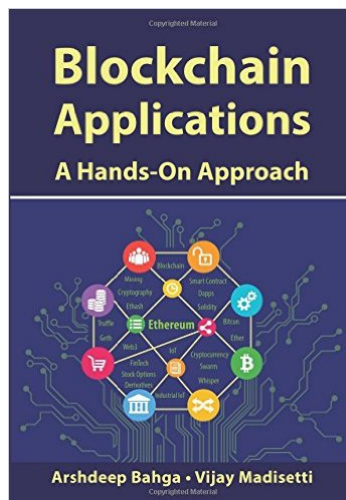
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1. **Advances in Parallel & Distributed Simulation**
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   San Diego, CA: SCS Press, 1991, 200 pp.

2. **Modeling, Analysis, Simulation of Computer & Telecommunications Systems**
   Madisetti, V., Gelenbe, E., Walrand, J. W. (Editors)
   Los Alamitos: CA, IEEE Computer Society Press, 1994, 425 pp.

3. **Modeling & Simulations on Microcomputers**

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San Diego, CA: SCS Press, 138 pp. 1990.

Editorship of Journals & Transactions

1. **IEEE Design & Test of Computers**
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2. **IEEE Design & Test of Computers**
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3. **IEEE Transactions on Circuits & Systems II**
   Associate Editor: 1993-1995.

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1. **Trends in the Electronic Control of Mine Hoists**
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24. **Combined modulation and error correction codes for storage channels**
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27. **All-digital oversampled front-end sensors**
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28. **Modeling COTS components in VHDL**
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29. **VHDL-Based Rapid Systems Prototyping**
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31. **Incorporating cost modeling in embedded-system design**
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33. **A case study in the development of multi-media educational material: the VHDL interactive
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     *Gadient, A.J.; Stinson, J.A., Jr.; Taylor, T.C.; Aylor, J.H.; Klenke, R.H.; Salinas, M.H.; Madisetti,
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     Jeongwook Kim; Madisetti, V.K.;
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35. **Efficient implementation of two-band PR-QMF filterbanks**
     Hezar, R.; Madisetti, V.K.;
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36. **On fast algorithms for computing the inverse modified discrete cosine transform**
     Yun-Hui Fan; Madisetti, V.K.; Mersereau, R.M.;
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37. **System on chip or system on package?**
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42.   **A new protocol to enhance path**
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44.   **Systematic Design of End-to-End Wireless Mobility Management Prototocols,**
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45.   **A Novel End-to-End Approach for Video Streaming Over the Internet,**
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IEEE Transactions on Multimedia, Submitted for review in March 2005.

47.   **Modeling the Effect of Handoffs on Transport Protocol Performance,**
Argyriou, A.; Madisetti, V. K.;
IEEE Transactions on Mobile Computing, Submitted for review in March 2005

48.   **Throughput Models for Transport Protocols with CBR and VBR Traffic Workloads",**
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Ph.D. Students Graduated

1. **Brian T. Kelley, 1992**
   VLSI Computing Architectures for High Speed Signal Processing
   Member of Technical Staff, Motorola.

   Winner of Dr. Thurgood Marshall Dissertation Fellowship Award

2. **Bryce A. Curtis, 1992**
   Special Instruction Set Multiple Chip Computer for DSP
   Member of Technical Staff, IBM

3. **Jaejin Lee, 1994**
   Robust Multitrack Codes for the Magnetic Channel
   Professor, Yonsei University, Korea

4. **Mohamed S. Ben Romdhane, 1995**
   Design Synthesis of Application-Specific IC for DSP
   Director of IP, Rockwell.

5. **Shoab A. Khan, 1995**
   Logic and Algorithm Partitioning on MCMs
   Professor, National University of Science & Technology, Pakistan

6. **Lan-Rong Dung, 1997**
   VHDL-based Conceptual Prototyping of Embedded DSP Architectures
   Professor, National Chaio Tung University, Taiwan.

   Winner of VHDL International Best PhD Thesis Award, 1997

7. **Thomas W. Egolf, 1997**
   Virtual Prototyping of Embedded DSP Systems
   Distinguished Member of Technical Staff, Agere

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8. **Alvaro Marenco, 1997**
    On Homomorphic Deconvolution of Bandpass Signals
    Professor, Texas A&M University.

    Winner of GIT ECE Outstanding Teaching Assistant Award

9. **Shahram Famorzadeh, 1997**
    BEEHIVE: A Distributed Environment for Adaptive Signal Processing
    Member of Technical Staff, Rockwell.

10. **Timothy J. Klausutis, 1997**
    Adaptive Lapped Transforms with Applications to Image Coding.
    US Air Force/Univ. of Florida.

11. **Lan Shen, 1998**
    Temporal Design of Core-Based Systems
    Member of Technical Staff, IBM

12. **James DeBardelaben, 1998**
    Optimization Based Approach to Cost Effective DSP Design
    Research Scientist, Johns Hopkins University

    Georgia Tech ECE Faculty Award

13. **Sangyoun Lee, 1999**
    Design of Robust Video Signal Processors
    Professor, Yonsei University

    US Army Sensors Lab Research Excellence Award, 1999

14. **Rahmi Hezar, 2000**
    Oversampled Digital Filters
    Member of Technical Staff, Texas Instruments

15. **Yong-kyu Jung, 2001**
    Model-Based Processor Synthesis
    Professor, Texas A&M University

16. **Mustafa Turkboylari, 2002**
    Handoff Algorithms for Wireless Applications
    Member of Technical Staff, Texas Instruments

17. **Yun-Hui Fan, 2002**
    A Stereo Audio Coder with Nearly Constant Signal to Noise Ratio
    Post-Doctoral Research Associate, Northeastern University

18. **Subrato K. De, 2002**
    Design of a Retargetable Compiler for DSP
    Member of Technical Staff, Qualcomm

    US Army Sensors Lab Research Excellence Award, 1999

19. **Chonlameth Aripnikanondt, 2004**
    System-on-Chip Design with UML
    Professor, King Mongkut's University, Thailand.

Professor Vijay K. Madisetti, ECE

<u>US Army Sensors Lab Research Excellence Award, 1999</u>

20. **Loran Jatunov, 2004**
Performance Analysis of 3G CDMA Systems
Senior Research Scientist, Soft Networks, LLC.

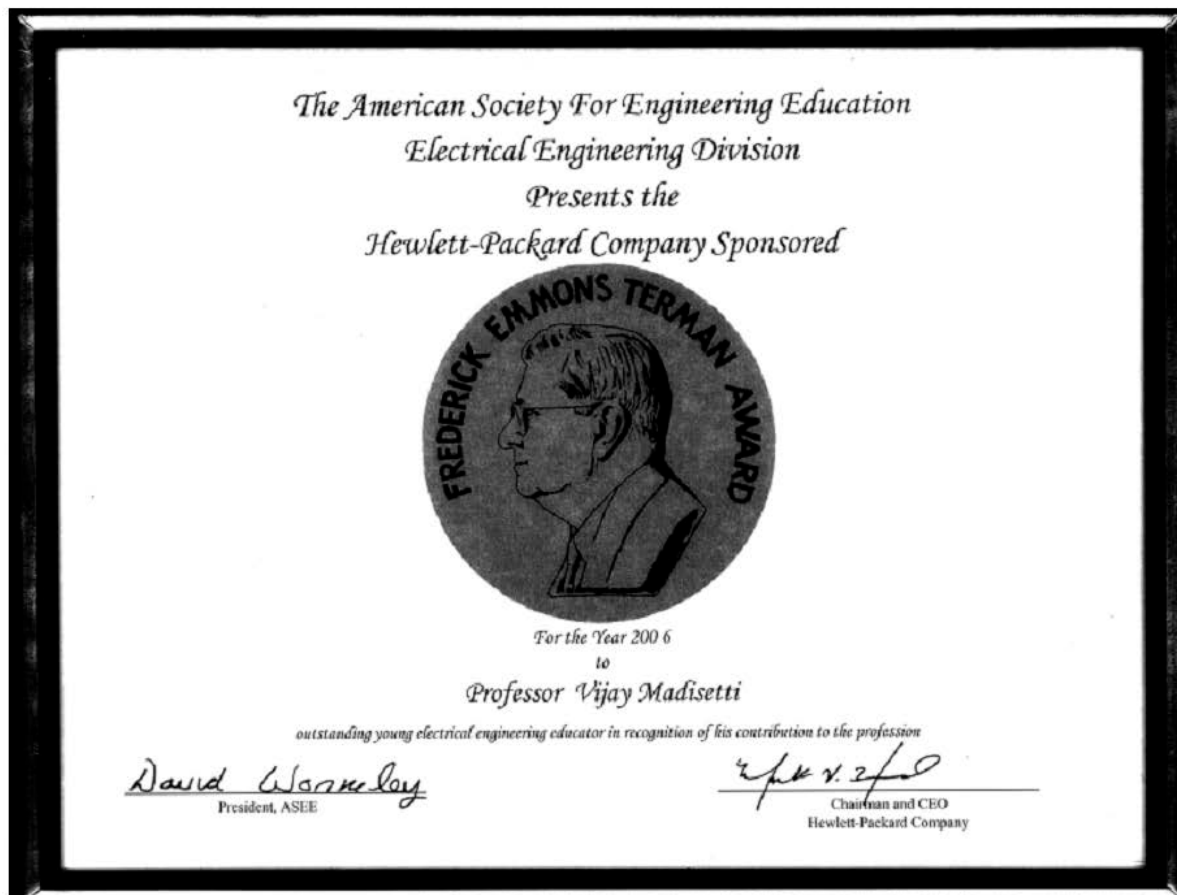21. **Antonios Argyriou, 2005**, Serving in Hellenic Army.

22. **Pilho Kim, 2009, Scientist, VP Technologies, Inc.**

23. **M. Sinnokrot, 2009, Staff Engineer, Qualcomm.**

Awards & Honors

1. **Jagasdis Bose National Science Talent Fellowship**, Indian Institute of Technology, Kharagpur, 1980-1984.

2. **General Proficiency Prize**, Indian Institute of Technology, Kharagpur, 1984.

3. **Demetri Angelakos Outstanding Graduate Student Award**, Univ. of California, Berkeley, 1989

4. **Ira Kay IEEE/ACM Best Paper Award** for Best Paper presented at IEEE Annual Simulation Symposium, 1989

5. **IBM Faculty Development Award** 1990

6. **Technical Program Chair**, IEEE Workshop on Parallel and Distributed Simulation. 1990.

7. **Technical Program Chair**, IEEE MASCOTS'94

8. **NSF RI Award**, 1990

9. **VHDL International Best PhD Dissertation Advisor Award**, 1997

10. **Georgia Tech Outstanding Doctoral Dissertation Advisor Award**, 2001.

11. **ASEE 2006 Frederick Emmons Terman Medal, 2006.**

12. **Fellow of IEEE**

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President, ASEE

Chairman and CEO
Hewlett-Packard Company

Intellectual Property Disclosures (Georgia Tech)

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2815	2003	How to Rapidly Develop a SyD Application
GSU-023	2003	Rapid Development of SyD Applications
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2718	2003	A Transport Layer Algorithm for Improved Anycast Communication
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2716	2003	A Transport Layer QoS Algorithm
2715	2003	A Novel Transport Layer Algorithm for MPLS Performance
2659	2002	A New Algorithm and Technology for Implementing Mobile IP with Applications to Voice and Video over Mobile IP
2656	2002	Debugging with Instruction-Level Reverse Execution
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2539		System of Databases: An Enabling Technology for Programming
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2480	2001	Mobile Fleet Application based on SyD Technology
2479	2001	System of Databases: A model with coordination links and a calendar application
1893	1999	Beehive
1726	1995	Very High Scale Integrated Circuit Hardware Description Language Models (VHDL Models)
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Issued Patents (Eight Patents Issued or Allowed)

Appendix B

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DECLARATION OF BOBBIE J. WILSON

EXHIBIT 27

(Redacted Version - Sought to be Sealed)

DECLARATION OF BOBBIE J. WILSON

EXHIBIT 28

(Redacted Version - Sought to be Sealed)